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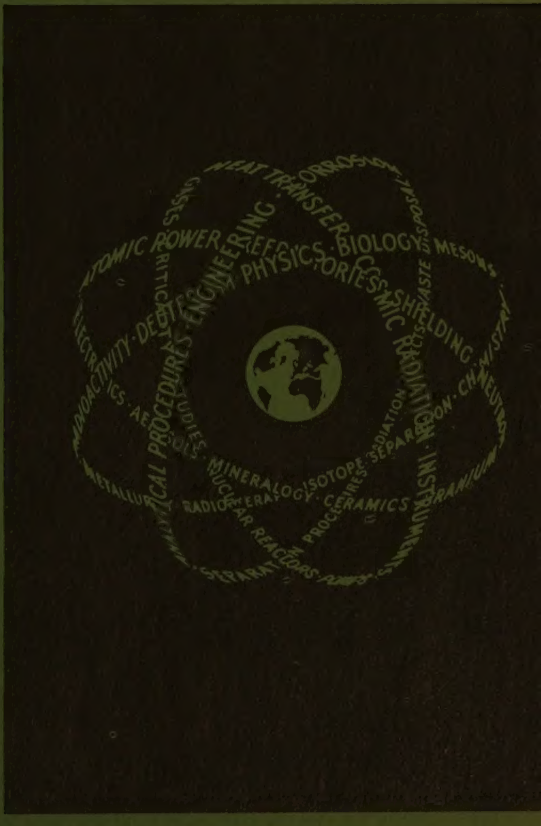
NUCLEAR SCIENCE ABSTRACTS



January 15, 1959

Volume 13 Number 1
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NUCLEAR SCIENCE ABSTRACTS

Volume 13 Number 1 January 15, 1959

GENERAL

1 AERE-READING LIST-2
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE UNITED KINGDOM ATOMIC POWER PROGRAMME. A SELECTED READING LIST. N. Skeats, comp. July 1958. 10p.

This list supersedes AERE-Inf/Bib-97 (second edition), March 1957.

A selective bibliography on the atomic power program and the power reactors in the United Kingdom is presented. (W.D.M.)

2 AERE-READING LIST-3
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A LIST OF BRITISH BOOKS AND PERIODICALS ON ATOMIC ENERGY. N. Skeats, comp. July 1958. 22p.

This list supersedes AERE-Inf/Bib-100 (May 1956) and Addenda (January 1957).

A list of British books and periodicals on atomic energy including sections on reactors, nuclear and atomic physics, quantum theory and wave mechanics, isotopes, instrumentation, radiochemistry, and radiation hazards is presented. The list of books includes both popular expositions and advanced texts written for the specialist. (W.D.M.)

3 GAT-247
Goodyear Atomic Corp., Portsmouth, Ohio.
FOUR-TOWER WATER TREATMENT TEST FACILITY. R. G. Murray and M. E. Tester. Sept. 23, 1958. 17p. Contract AT(33-2)-1. \$3.30(ph OTS); \$2.40(mf OTS).

A four-tower water treatment test facility was built for the study of corrosion in copper condenser tubes. A two-by-two factional experiment was run using phosphate treated water at two levels of water velocity and two water temperatures. The system was operated continuously for ninety days after which the tubes were removed for inspection. After being split open, the tubes were visually inspected for pitting corrosion. Pits were found in the tubes from the two towers operating at low water velocity; these pits were more severe in the high temperature units. Silt deposits were much less in the low temperature, high velocity unit than in the other units. Subsequent tests will be made using a variety of corrosion inhibitors since results indicate that it is possible to simulate plant conditions in the laboratory. (auth)

4 TID-3522
Technical Information Service Extension, AEC.
PEACEFUL USES OF NUCLEAR EXPLOSIONS. A Literature Search. Oct. 1958. 5p. \$0.50(OTS).

Twenty-five references to report and published literature are given. (T.R.H.)

5
MISSILE ENGINEERING HANDBOOK. PRINCIPLES OF GUIDED MISSILE DESIGN. C. W. Besserer. Princeton, N. J., D. Van Nostrand Company, Inc., 1958. 604p.

A collection of information for use in the development, design, and test phases of the guided missile field is presented. In section one general data are given on U. S. guided missiles. Conversion tables, physical constants, atomic weights and other general information are included. The other sections present tables, graphs, and equations on: properties of the atmosphere, environmental data and reliability, properties of materials and structures, aerodynamics, avionics, propulsion, and space flight. A glossary of guided missile terms is appended. (T.R.H.)

6
BIOLOGICAL TREATMENT OF SEWAGE AND INDUSTRIAL WASTES. VOLUME II. ANAEROBIC DIGESTION AND SOLIDS-LIQUID SEPARATION. Joseph McCabe and W. W. Eckenfelder, Jr., eds. New York, Reinhold Publishing Corporation, 1958. 335p.

Twenty-eight papers on various aspects of anaerobic digestion and solids-liquid separation are presented. The material, originally presented at a conference at Manhattan College in April 1957, is divided into three parts entitled: anaerobic treatment, sedimentation and flotation, and vacuum filtration and sludge conditioning. (T.R.H.)

7
NUCLEAR ROCKET PROPULSION. R. W. Bussard and R. L. DeLauer. New York, McGraw-Hill Book Company, Inc., 1958. 378p.

Basic rocket performance is discussed to establish performance parameters. From this a systems approach to over-all missile performance is developed. The system analysis is then used to determine the performance regions where nuclear rockets are of interest, and to optimize design variables. Other material is then discussed in sections on: heat transfer and fluid flow; materials; nucleonics; system control; and testing. Some possibilities are suggested for advanced high-performance nuclear propulsion systems. (T.R.H.)

BIOLOGY AND MEDICINE

8 AF-SAM-57-61
School of Aviation Medicine, Randolph AFB, Tex.
LETHAL EFFECTS OF GAMMA RADIATION OF NEUROSPORA CONIDIA. Robert D. Gafford. July 1957. 20p.

9 AF-SAM-58-100
School of Aviation Medicine, Randolph AFB, Tex. and Texas. Univ., Austin. Radiobiological Lab.
RADIATION EFFECTS ON AQUEOUS SOLUTIONS OF S,2-AMINOETHYLISOTHIURONIUM SALTS. Donald R. Anderson and Betty J. Joseph. Apr. 7, 1958. 6p.

Buffered aqueous solutions of AET showed marked sensitivity to ionizing radiation. Two methods of determining the concentration of sulfhydryl groups were used with comparable results. The destruction of sulfhydryl groups is directly dependent on radiation dose. The high yield suggests that a chain-type reaction may account for the radiation sensitivity. In deoxygenated samples, the radiation effect was decreased 47%; however, the effect was not altered with the addition of catalase or by saturation with oxygen. It is suggested that the protective activity of AET involves not only the sensitivity to radiation of the free sulfhydryl group, but also the capacity of the compound to couple with sensitive biologic molecules and shield them from radiation damage. (auth)

10 AF-SAM-58-115
School of Aviation Medicine, Randolph AFB, Tex. and Texas. Univ., Austin. Radiobiological Lab.
SOME EFFECTS OF IONIZING RADIATIONS ON CREATINE PHOSPHOKINASE. Donald R. Anderson. May 8, 1958. 9p.

Aqueous solutions of creatine phosphokinase were inhibited by Co^{60} gamma radiation. An exponential inactivation curve resulted. Irradiation at various enzyme concentrations showed the G yield increasing with increasing concentrations. A maximum G value of 0.47 was obtained. Investigation indicated that probably the OH radical was responsible for the inhibition of enzyme activity. The enzyme was studied using AET salts as protective and reactivating compounds. pH and concentrations of the protective compounds were investigated in relation to their protective capacity. A protective mechanism involving a shielding linkage rather than a radical sink process has been suggested to account for the protective effect of some of these compounds. (auth)

11 HW-46333
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES. Quarterly Progress Report [for] July–September 1956. J. W. Healy, ed. Oct. 30, 1956. Decl. Oct. 2, 1958. 31p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Reorganization of Hanford Atomic Products Operation with the elimination of the Radiological Science Department as a separate organizational entity is reported. Organizational structure of the new Hanford Laboratories Operation is outlined. Progress is reported in the following studies: a radiobiological-ecological survey of the Columbia River; the effect of reactor effluent on aquatic organisms; the effect of nutritional state on thyroidal uptake of I^{131} in swine; the I^{131} concentration in fetal thyroids in sheep during various stages of gestation; the effects of whole-body x irradiation on the leukocyte count in sheep; the transfer of radiostrontium to sheep milk following oral ingestion; Pu absorption and metabolism in young rats; fission product absorption and metabolism in rats; radiation injury to the exteriorized intestine of rats; the pathological effects of radioactive particles deposited in the lungs of mice; factors affecting the uptake of fission products by plants; the genetic effects of S^{35} β particles in the growth media of yeast; the radiobiological monitoring of the Columbia River; the monitoring of reactor effluent water; development of a tentative procedure for the determination of the rare earth group in reactor effluent water; investigations in the development of chemical dosimeters; meteorological studies on particle diffusion and transport in which fluorescent particles were used as tracers to study the growth of a smoke plume in both the vertical and horizontal directions; development of an instrument employing a scintillation counter to measure Pu concentration in wounds of the hands; and the development of instruments for neutron dosimetry and an α air monitor. (C.H.)

12 NP-6973
Duke Univ., Durham, N. C.
MICROWAVE AND RADIOFREQUENCY SPECTROSCOPY. Status and Technical (Progress) Report No. 25 [for] May 1, 1958–August 1, 1958. 58p. Project No. 599-01-004. Contract DA-36-034-ORD-1233.

The method of electron spin resonance was used to study the effects of ionizing radiations on various biological substances ranging in complexity from the simplest constituents of proteins to cellular materials. Applications of the findings in understanding the biological function of molecules, certain aspects of radiation injury, and the protective effects of some chemical substances against radiation injury are discussed. The method of electron spin resonance is also being used to study the free radicals produced in various plastics such as lucite, polystyrene, and related simpler organic molecules. (For preceding period see AD-137101.) (C.H.)

13 UR-535
Rochester, N. Y. Univ. Atomic Energy Project.
IN VIVO LOCALIZATION STUDIES OF I^{131} LABELED ANTI-MURPHY-STURM LYMPHOSARCOMA ANTIBODIES. Irving L. Spar, William F. Bale, and Ruth L. Goodland. Sept. 23, 1958. Contract W-7401-eng-49. $4.80(ph OTS); $2.70(mf OTS).

Using primarily a preiodination purification procedure, I^{131} labeled Murphy-Sturm tumor antisera preparations have been made that will localize preferentially in this tumor growing in the rat. It does not localize in this tumor growing in the hamster cheek pouch. Localization in the rat tumor can be obtained with antisera induced by rat-grown tumor purified with rat tumor and with antisera induced by hamster-grown tumor purified with rat tumor. This indicates that some of the antigens responsible for uptake of the labeled antibody are common to the tumor grown in both species. It has also been shown that the purified antibody reacts primarily with the rat fibrin-fibrinogen system and this plays a major role in the localization of the purified antibody preparations. (auth)

14 USNRDL-TR-250
Naval Radiological Defense Lab., San Francisco.
AUTOLOGOUS BONE MARROW PROTECTION AFTER FAST NEUTRON IRRADIATION OF DOGS. E. L. Alpen and S. J. Baum. July 24, 1958. 13p.

15 AEC-tr-3347
BIOLOGICAL EFFECT OF IONIZING RADIATION IN THE LIGHT OF CONTEMPORARY OPINIONS ON THE NATURE OF D.N.A. A. M. Kuzin. Translated for Oak Ridge National Lab. from Izvest. Akad. Nauk S.S.S.R., Ser. Biol., 273-84(1957). 29p.

Basic biological reactions induced by exposure to ionizing radiation are reviewed in the light of contemporary opinions on the nature of nucleoproteins and complex systems of protein enzymes. The influence of radiation on high-polymer nucleoproteins and nucleic acids and the radioinduced formation of abnormal crystals in irradiated nucleoproteins, the influence of radiation exposure on the synthesis of specific protein enzymes which lead to related disturbances in exchange reactions, and radioinduced changes in osmosis and in the sorption of enzymes at the surface of microstructures as a consequence of radioinduced depolymerization of the high-molecular complex proteins of live tissue are discussed. (C.H.)

16

RECENT EXPERIMENTAL CONTRIBUTIONS TO RADIOTHERAPY. Henry S. Kaplan (Stanford Univ. School of Medicine, San Francisco). Am. J. Roentgenol. Radium Therapy Nuclear Med. 80, 822-32(1958) Nov.

Recent concepts of tissue radiation response are reviewed. Studies are discussed which cover effects elicited by radiation events occurring within the cells, tissue responses mediated by radiation effects in the environment, and effects related to the nature and mode of application of the agent. Applications in the field of clinical radiotherapy are stressed. 99 references. (C.H.)

17

TUMOR RESPONSE TO IONIZING RAYS AT ELEVATED TEMPERATURES. Oleg S. Selawry, James C. Carlson, and George E. Moore (Roswell Park Memorial Inst., Buffalo, N. Y.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 80, 833-9(1958) Nov.

A review of the literature suggests that ionizing radiation is more damaging to cancer cells at elevated temperatures. The combination of heat and roentgen ray therapy is therefore potentially useful against radioresistant and poorly accessible tumors. Further critical studies are necessary in order to elucidate the nature of the synergism involved, to determine the optimal sequence, and to investigate unfavorable side effects on the host. 81 references. (C.H.)

18

LOCALIZED ROENTGEN-RAY BEAM IRRADIATION OF THE HYPOPHYSOHYPOTHALAMIC REGION OF GUINEA PIGS WITH A 2 MILLION VOLT VAN DE GRAAFF GENERATOR. H. Pourquier, J. R. Baker, G. Giaux, and K. Benirschke (Tufts Univ. School of Medicine, Boston). Am. J. Roentgenol. Radium Therapy Nuclear Med. 80, 840-50(1958) Nov.

Small cross-sections of beams were easily obtained with a 2 million volt roentgen ray generator, permitting localized irradiation of the hypophysohypothalamic region of adult guinea pigs. Dosage was determined by roentgenographic means. High doses from 2,000 to 18,000 r were given in a single application. No radiation sickness was noted. After a symptom-free interval, which varied exponentially with the intensity of the irradiation between 4,500 and 18,000 r, there was selective degeneration occurring focally mostly in the white matter of the brain. This alteration involved the optic tract, cerebral peduncles, areas of hypothalamus and the subependymal area of the lateral ventricles. It appeared to be independent of simultaneously occurring vascular changes. There was no appreciable effect on the cortex, neurons and meningeal vessels. Even with doses above 4,500 r, the pituitary gland showed no necrosis or vascular changes. The general picture demonstrated reduction of acidophils and an increase of sparsely granulated basophils. Random pyknosis was more marked at higher dosage and there was a change in the time interval between irradiation and death of the animal. The examination of other endocrine glands suggested continuing stimulation by the pituitary gland after irradiation. It was impossible to decide from these experiments whether the pituitary gland was so severely damaged as to undergo necrosis in the future since the adjacent cerebral structures were damaged more readily, thus preventing survival of the irradiated animals. (auth)

19

RADIATION CHARACTERISTICS OF A KILOCURIE REVOLVING COBALT 60 THERAPY UNIT. Lawrence H. Lanzl and Lester S. Skaggs (Argonne Cancer Research Hospital, Chicago). Am. J. Roentgenol. Radium Therapy Nuclear Med. 80, 851-61(1958) Nov.

This machine has demonstrated that the advantage of small scattering of high energy radiation need not be sacrificed to the large penumbra resulting from the use of extended sources. It has been demonstrated that specific activities in the range of hundreds of curies per gram can be produced. It is easy, with a modest expenditure in self-absorption, to achieve sources of less than 1 cm diameter, but sources of 0.5 cm diameter seem outside the range of practical achievement. It is evident from the single beam isodose distributions that a small penumbra was indeed achieved. Significant differences in distribution are obtained by changing from complete rotation to sector rotation. Depth dose distributions for moving beams of small cross-section show a very rapid fall-off of dose outside the tumor region. As the cross-section of the beam approaches that of the phantom, this fall-off becomes less steep. (auth)

20

INSTRUMENTAL AND TECHNICAL NOTES. A TELEVISION-RÖNTGEN SYSTEM FOR PENDULUM THERAPY. Henry Wallman and Nils Stalberg (Chalmers Univ. of Tech., Gothenburg, Sweden). Brit. J. Radiol. 31, 576-7 (1958) Oct.

A block diagram is presented of a television-roentgen system for making observations during pendulum therapy. Problems of sensitivity, resolution, and contrast are discussed. (C.H.)

21

AIR DENSITY CORRECTION FACTOR FOR IONIZATION CHAMBERS. M. L. Emmett (Bristol Royal Hospital, Eng.). Brit. J. Radiol. 31, 577(1958) Oct.

A chart is presented for use when ionization chamber measurements are made on patients. Using temperature and pressure as axes, the chart is easy to use and covers body temperature range. (C.H.)

22

THE EFFECT OF X-RAY TREATMENT UPON THE CONTENT OF CHLOROPHYLL AND HEMICELLULOSE IN WHEAT LEAVES. I. M. Vasil'ev, Tzin Su-yun, and N. D. Rybalka (Inst. of Biological Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 121, 450-2(1958) July 21. (In Russian)

The effects of x radiation on the chlorophyll and hemicellulose content in wheat leaves were tabulated. The results show accumulation of chlorophyll due to depressive effects of irradiation on the growth (at 1000 r the growth was not completely depressed and at 3000 and 5000 r the growth was depressed completely) and a reduction in hemicellulose content in the irradiated leaves (no special differences were observed at 3000 and 5000 r). (R.V.J.)

23

VARIATION IN THE SEX RATIO IN MICE, AS A POSSIBLE RESULT OF γ-IRRADIATION OF THEIR EMBRYOS. F. B. Shapiro and N. I. Shapiro (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 122, 215-18(1958) Sept. 11. (In Russian)

The fertility of mice irradiated during gonad development and the secondary sexual organ development period in embryos was investigated. The data were used for further studies of the possible influence of gamma radiation on sex ratios in mice. (R.V.J.)

24

BIOLOGICAL EFFECTS OF BETA-RADIATION IN EXTERNAL IRRADIATION. S. N. Aleksandrov, K. F. Galkovskaya, O. G. Matveev, and V. A. Petrov (Central Research Roentgen-Radiological Inst. of Ministry of Health, USSR). Med. Radiol. 3, No. 4, 6-8(1958) July-Aug. (In Russian)

A special β applicator was designed for irradiation of animals. The active layer of the β applicator contained 460 mc of Sr^{90} and emitted 25 r per minute on the surface. Mice were irradiated with 65, 125, 250, and 500 r. The percentage of survival was investigated, as well as hematological changes and rapidity of wound healing. (tr-auth)

25

CHANGES IN THE PHYSICAL THERMOREGULATION FOLLOWING SINGLE GENERAL IRRADIATION OF RABBITS OF X RAYS IN THE DOSE OF 1000 r. I. N. Kondratieva. Med. Radiol. 3, No. 4, 8-15(1958) July-Aug. (In Russian)

Pronounced disturbance of the physical thermoregulation is noted within 24 to 48 hours after irradiation. There is an absence of actue weakening of the vascular and respiratory reactions. From the 2nd to the 9th day there is an unstable reestablishment of the physical thermoregulation. However, the respiratory component of this thermoregulation is, as a rule, less than its initial value. An acute depression of the physical thermoregulation is noted again 2 to 6 days before the death of the animals. Depression of the vascular and respiratory reactions soon after irradiation are probably caused by the inhibition of the spinal centers, which is connected with excitation of the brain. Further changes in the physical thermoregulation depend on the condition of the property of the correcting central nervous system. (tr-auth)

26

INCLUSION OF PHOSPHORUS IN NUCLEIC ACIDS OF RATS ORGANS IN LETHAL X RAY IRRADIATION. A. S. Orlov (Central Research Inst. of Roentgen-Radiol.). Med. Radiol. 3, No. 4, 16-21(1958) July-Aug. (In Russian)

A method is offered for determining the rate of phosphorus inclusion into nucleic acids of rats. (R.V.J.)

27

UTILIZATION OF OXYGEN BY RATS AND MICE DURING X-RAY IRRADIATION. I. S. Belokonskii (Scientific-Research Military Medical Inst., Sofia). Med. Radiol. 3, No. 4, 21-5(1958) July-Aug. (In Russian)

Utilization of oxygen was investigated during x-ray irradiation in 30 white rats and 50 white mice. Oxygen intake was registered every minute or every 5 minutes in cubic cms with irradiations of 600 to 700 and 3000 to 3500 r. During single general irradiation by 600 to 700 r utilization of oxygen by the animals is increased 25 to 35%. Later, in continuous or fractional (each dose being 500 r) irradiation it gradually decreased. Pronounced undulatory variations in the oxygen intake with the amplitude of 130 to 34% were noted during continuous irradiation by 3000 r and following it. However, the general tendency of the intake value was towards decrease. (tr-auth)

28

THE EFFECT OF REPEATED GENERAL IRRADIATION BY SMALL DOSES OF X-RAY ON BONE TISSUE. N. A. Zhizhina (Moscow Medical Stomatological Inst.). Med. Radiol. 3, No. 4, 25-9(1958) July-Aug. (In Russian)

Changes in mineral metabolism were studied in the bones of white rats after repeated fractional irradiation by small doses (25 r) of x ray. Examination of mineral metabolism was carried out by determination of induced P^{32} and Ca^{45} activity. Fractional irradiation of rats by small doses of x ray for 68 days (the total dose being 700 r) causes certain activation of the phosphorus-calcium metabolism during 15 days following the final irradiation. Depression of metabolic processes in the bone tissue for 15 days after final irradiation was noted during numerous repeated irradiations of rats by small doses of x rays for 90 days (the total dose being 900 r). Changes revealed in the hard bone tissue (in the form of disturbances of the phosphorus calcium metabolism) are the indications of changes in the trophic processes of the bone tissue. (tr-auth)

29

ON THE APPLICATION OF PENTOXYL IN RADIATION LEUKOPENIA IN MAN. M. P. Domshlak and L. B. Koznova. Med. Radiol. 3, No. 4, 29-33(1958) July-Aug. (In Russian)

Effects of pentoxyl were studied in patients suffering from leukemia developed after repeated exposures to x radiation. Administration of pentoxyl produced some stimulating effects on leukocytopoiesis. Therapeutic effects were expressed in an increased number of neutrophils. However, the stimulating effect of pentoxyl is not stable enough and should be followed by other measures. (R.V.J.)

30

THE PROTECTIVE EFFECT OF CHONDROITIN SULFATE AGAINST LETHAL DOSES OF X RAYS. N. V. Petrova, L. I. Polikarpova, et al. Med. Radiol. 3, No. 4, 34-41(1958) July-Aug. (In Russian)

Intravenous injection of chondroitin sulfate (0.25 to 1 mg per 1 g of body weight) 5 to 10 min before irradiation resulted in an increased survival of mice (40 to 50%), a much more rapid rehabilitation of the number of leucocytes and leucocytic blood formula, and a more intensive regeneration of the fibroblastic group in the friable connective tissue. (R.V.J.)

31

TREATMENT OF STAPHYLOCOCCUS PNEUMONIA IN RADIATION SICKNESS. P. N. Kiselev, R. M. Rabinovich, and I. D. Meter (Central Scientific-Research Roentgen-Radiological Inst., Ministry of Health, USSR). Med. Radiol. 3, No. 4, 41-6(1958) July-Aug. (In Russian)

Effects of streptomycin, penicillin, and bicillin on experimentally induced staphylococcus pneumonia in radiation sickness were investigated on 20 rabbits and 140 white rats. Efficacy of antibiotics was evaluated on the basis of clinico-roentgenological and bacteriological methods of treatment. The results of observations showed that early diagnosed pneumonia may be cured in prolonged administration of antibiotics even if it takes place on the background of radiation sickness. It was established by bacteriological experiments that treatment by streptomycin and bicillin promotes liberation of the organism from the microbes. It was completely freed from them on the 6th day after the infection. Treatment of staphylococcus pneumonia was unsuccessful in a number of irradiated animals and depended on the time of its commencement, its length, and the appearance of antibiotic-resistant forms of microbes. (tr-auth)

32

THE SENSITIVITY OF IRRADIATED ANIMALS TO

PATHOGENIC LEPTOSPIRA. I. I. Grigorev (Voronezh Roentgen-Radiological and Oncological Inst.). Med. Radiol. 3, No. 4, 46-50(1958) July-Aug. (In Russian)

Experiments with white rats showed an increased sensitivity of irradiated animals to pathogenic leptospira. (R.V.J.)

33

VACCINE TULAREMIC INFECTION IN WHITE MICE IN CONDITION OF RADIATION SICKNESS. A. S. Shevelev (Smolensk Med. Inst.). Med. Radiol. 3, No. 4, 50-6 (1958) July-Aug. (In Russian)

Preliminary irradiation of white mice by sublethal dose of x rays (370 r) causes acute decrease in natural immunity to vaccine tularemic infection. This is most pronounced if infection takes place within 2 to 24 hours after irradiation. It is clearly evident after 3 days, the infection decreases in 7 to 10 days, and disappears almost completely in introduction of vaccinal strain in 21 to 22 days following irradiation. There is a certain parallelism between the degree of depression of resistance of vaccine tularemic infection as a result of ionizing radiation and the decrease in the number of lymphocytes in the peripheral blood. Direct relationship is noted between the degree of depression of congenital immunity as a result of irradiation and the degree of multiplication of tularemic bacteria in the bone marrow and, partially, in the spleen. (tr-auth)

34

HISTOCHEMICAL STUDY OF THE PHAGOCYTIC PROCESSES IN THE RABBIT APPENDICES IN X-RAY IRRADIATION. A. Ya. Fridenstein (Gamalei Inst. of Epidemiology and Microbiology, Academy of Medical Sciences, USSR). Med. Radiol. 3, No. 4, 56-64(1958) July-Aug. (In Russian)

The study of the dynamics of phagocytic processes was carried out in the appendicular wall of normal and irradiated rabbits. Histochemical methods of detection of polysaccharides were used. It appeared that a considerable amount of microbes which constitute the natural flora of the large intestine penetrate through the epithelium of appendix of normal adult rabbits. These microbes are seized by reticular cells of lymphoid follicles and are digested in the process of multiphasic phagocytosis. As a result of this, a large number of substances formed in decomposition of microbes are deposited in the centers of multiplication of the follicles, in the wall of the appendix the greater part of these substances give a positive reaction to polysaccharides. The total x-ray dose of 600 to 800 r causes disturbance of the phagocytic apparatus referred to above: the process of phagocytosis by macrophages becomes incomplete and the process of deposition of the substances formed in destruction of microbes becomes disturbed. The apparatus of phagocytic protection which was revealed in the intestinal wall points to the role of macrophagic reaction in the natural immunity. Evidently, the development of radiation bacteremia is connected with disturbance of this reaction in irradiation. (tr-auth)

35

THE CONDITION OF HEARING IN RADIATION SICKNESS. M. Ya. Kozlov (Kirov Leningrad State Medical Post-Graduate Inst.). Med. Radiol. 3, No. 4, 64-9(1958) July-Aug. (In Russian)

The condition of the peripheral ending of the auditory analyzer of the internal ear was studied in radiation sickness caused by sublethal doses of x ray (350 r). Experiments were performed on guinea pigs; an objective method of registration of the cochlear biocurrents was applied. It was demonstrated that when guinea pigs are irradiated by x rays in the dose of 350 r an acute radiation sickness results with 50% mortality. There is a decrease of auricular reflex with decrease of the bioelectric potentials of the cochlea to all frequencies (from 500 to 8.000 hertz) and 3.9 to 9.1 decibels, on the average. (tr-auth)

36

BIOLOGICAL EFFECTS OF IONIZING RADIATION ON THE AGING PROCESSES AND THE SPAN OF LIFE. V. I. Korogodin and G. G. Polikarpov. Med. Radiol. 3, No. 4, 79-85(1958) July-Aug. (In Russian)

A review is given of data on the effects of ionizing radiation on aging and span of life. An extensive bibliography is included. (R.V.J.)

37

ALTERATIONS IN GLUCOSE ABSORPTION FROM THE INTESTINES DURING ACUTE RADIATION SICKNESS. D. A. Golubentsev. Med. Radiol. 3, No. 4, 86-7(1958) July-Aug. (In Russian)

The rate of glucose absorption from the intestines during radiation sickness was studied with 65 healthy and 160 irradiated mice 1, 4, 24, and 48 hours and 3 to 10 days after exposure to 750 r irradiation. (R.V.J.)

38

EFFECTS OF IONIZING RADIATION ON THE IMMUNITY TO EXPERIMENTAL PARATYPHOID IN RABBITS. V. A. Snopkova. Med. Radiol. 3, No. 4, 87-8(1958) July-Aug. (In Russian)

Effects of total irradiation by 600 to 800 r on the vaccinated and post-infection immunity of rabbits to paratyphoid were investigated. (R.V.J.)

39

INABILITY OF EPINEPHRINE TO PROTECT RHODE ISLAND CHICKS AGAINST THE LETHAL ACTION OF X-RAY. M-L. Beaumariage (Univ. of Liege). Nature 182, 803-4(1958) Sept. 20

After 30 days the mortality of irradiated chicks treated with epinephrine in oil was the same as that of control chicks irradiated with 2,000 r. (C.H.)

40

DEPOSITION OF STRONTIUM-90 AND ITS CONTENT IN VEGETATION AND IN HUMAN DIET IN THE UNITED KINGDOM. R. Scott Russell (Agricultural Research Council Radiobiological Lab., Grove, Wantage, Berks, Eng.). Nature 182, 834-9(1958) Sept. 27.

The mechanism by which strontium-90 enters plants and other agricultural products, especially milk, is discussed. Based on results from surveys of world-wide fall-out and field experiments in which radioactive strontium was applied to the surface of agricultural land on which crops were raised, an attempt is made to formulate on equation for use in calculating the cumulative deposition of strontium-90 in vegetation and agricultural products. (C.H.)

41

EFFECT OF TOTAL BODY IRRADIATION ON CAPILLARY PERMEABILITY. G. Szabó, S. Magyar, P. Kertai, and E. Zádory (Inst. for Experimental Medicine, Hungarian Academy of Sciences, Budapest). Nature 182, 885-6(1958) Sept. 27.

A study was made of the disappearance of labeled plasma proteins from the circulation as well as their transport through the lymphatics after massive whole-body x irradiation of dogs. No increase in the transport of colloidal molecules through the capillary walls could be detected in the irradiated animals. The return of the extravasated protein molecules by way of the lymphatic channels was, however, greatly reduced. (C.H.)

42
CHROMATID BREAKAGE BY IRRADIATION AND THE OXYGEN EFFECT. G. J. Neary and H. J. Evans (Atomic Energy Research Establishment, Harwell, Berks, Eng.). *Nature* *182*, 890-1(1958) Sept. 27.

An investigation was made of the influence of oxygen on the structure and frequency of the various chromatid aberrations induced by x irradiation of *Vicia faba* roots. Data are tabulated. (C.H.)

43
EFFECT OF NITRIC OXIDE ON THE RADIOSENSITIVITY OF TUMOR CELLS. L. H. Gray, F. O. Green, and C. A. Hawes (Mount Vernon Hospital, Northwood, Middlesex, Eng.). *Nature* *182*, 952-3(1958) Oct. 4.

Nitric oxide was found to be comparable in effectiveness with oxygen in raising the radiosensitivity of mouse Ehrlich ascites tumor cells with respect to the loss of reproductive integrity of those cells on exposure to x radiation. (C.H.)

44
ARTIFICIAL MUTAGENESIS IN PLANT BREEDING. D. Roy Davies and E. T. Wall (Atomic Energy Research Establishment, Wantage, Berks, Eng.). *Nature* *182*, 955-6(1958) Oct. 4.

Problems involved in the use of radiation to induce mutations in plants and application in plant breeding programs are discussed. (C.H.)

45
AN OBSERVED 'OXYGEN EFFECT' DURING GAMMA-IRRADIATION OF DRIED BACTERIAL SPORES. Alan Tallentire (The Univ., Manchester, Eng.). *Nature* *182*, 1024-5(1958) Oct. 11.

Spores of *Bacillus subtilis* in secondary dried kaolin powder, irradiated in the presence of air, were found to be more sensitive to gamma radiation than spores in primary dried kaolin powder irradiated in the presence of air. Implications of the findings are discussed briefly. (C.H.)

46
INITIAL IRRADIATION REACTION IN MICE. Harold Blondal (University of Manitoba, Winnipeg, Can.). *Nature* *182*, 1026-7(1958) Oct. 11.

The radiation dose required for the inactivation of mice was found to decrease as the age of the animal increases. Data are tabulated. (C.H.)

47
PROBLEMS OF RADIOECOLOGY. A. A. Peredelskii. *Priroda* No. 8, 27-32(1958) Aug. (In Russian)

A review is given of some aspects of radioecology and its importance in agriculture. A suggestion is made for developing radioecological study as a separate branch of science. (R.V.J.)

48
HISTOPATHOLOGIC EFFECTS OF X-RAYS, RADIOPHOSPHORUS, NITROGEN MUSTARD, URETHANE, AND STEROIDS UPON THE SPLEEN IN LEUKEMIAS AND LYMPHOMAS. Matthew Block (Univ. of Colorado School of Medicine, Denver). *Radiology* *71*, 477-501 (1958) Oct.

Roentgen irradiation, radioisotopes, nitrogen mustard, and urethane induce strikingly similar changes in the spleens of patients with leukemias and lymphomas. Steroids differ from the above agents in their ability to cause reversion of the spleen of patients with acute myelogenous leukemia toward normal structure. The cytotoxic or inhibitory effect of a single dose of any agent is measured in hours, not days. Therapy may cause a lessening of clinical activity correlated with a minor or sometimes major decrease in malignant infiltrate but it never induces complete return to normal morphology. The decrease in tissue infiltrate appears to be due to a low-grade but repeated or continued destruction of susceptible cells plus a variable degree of mitotic inhibition. The histopathologic changes vary from minute to moderate and in general are not commensurate with the degree or duration of clinical improvement. Furthermore, the same histopathologic changes are noted regardless of whether or not a remission develops, suggesting that some factor other than decrease in amount of abnormal tissue is operative. However, a decrease in splenic size and fall in white cell count are closely correlated with the presence of cells undergoing karyorrhexis. (auth)

49
RADIATION BIOLOGY AND MEDICINE. Walter D. Claus. Reading, Mass., Addison-Wesley Publishing Company, Inc., 1958. 961p. $11.50.

A history is presented of the application of radiation to experimental biology and medical diagnosis and therapy. The influence of atomic energy on problems of growth and aging, ecology, meteorology, oceanography, and bioeconomics is discussed briefly. Technical papers are included from 56 authors. Topics covered include basic mechanisms of biological effects of radiation, mutational effects, mathematical biology, mammalian response, radiation safety, instrumentation and dosimetry, and medical, agricultural, and tracer applications of radioisotopes. A brief description is included of the United States training programs in radiation biology and related sciences. A list is appended of research contracts and grants supported by the Government and private agencies for the study of radiation effects and usage in the biological and medical sciences. (C.H.)

CHEMISTRY

General

50 AERE-C/R-1334
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE USE OF HOLLERITH COMPUTING MACHINES IN SPECTROSCOPIC TERM ANALYSIS. L. F. H. Bovey and C. W. Nott. Apr. 26, 1954. 14p.

One essential step in the term analysis of spectra is the sorting of the difference between the wave numbers of the lines appearing in the omission spectrum of the element concerned. This is basically a mechanical process and a method using the existing Hollerith installations has been devised for this purpose. The method is in three stages. From the experimentally measured wavelengths, to which the corrections for conversion into equivalent wavelengths in vacuo are added, the reciprocals are obtained. Secondly, all the differences are formed and these are then sorted into groups. Attempts have been made to extend the sorting so that groups of associated lines could be found automatically. The main difficulty here is set by the error spread arising from the uncertainty in the original data. Methods devised so far need a very large number of cards with a corresponding demand on machine time. Advantages of the general method include the accuracy, complete cross-checks for any errors, the flexibility of the possible sorting procedures and the use of existing machines. The preliminary results of the application of this procedure to the analysis of the rare-earth metals are briefly discussed. (auth)

51 AERE-R/R-2578

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE THERMAL CONDUCTIVITY OF AQUEOUS THORIA SUSPENSIONS. F. A. Johnson. June 1958. 31p. $0.81(BIS).

Experiments were carried out to determine the thermal conductivity of suspensions of thoria in ordinary water at temperatures in the range 0 to 100°C and at concentrations between 0 and 20% by volume. Three other systems, of similar concentration, were also investigated at 30°C. On the basis of these measurements and on similar work by other investigators, expressions are suggested for the calculation of slurry conductivity from the conductivities of the constituent substances together with the volume concentration of solids. (auth)

52 ANL-5875

Argonne National Lab., Lemont, Ill.

THE FLUORINATION OF PLUTONIUM TETRAFLUORIDE. M. J. Steindler, D. V. Steidl, and R. K. Steunenberg. June 1958. 29p. Contract W-31-109-eng-38. $1.00(OTS).

The fluorination of plutonium tetrafluoride by elemental fluorine to form plutonium hexafluoride was studied in a flow system at temperatures between 100 and 600°C. Partial pressures of fluorine from 0.25 to 1.0 atmosphere were used. The plutonium tetrafluoride was obtained from several sources, including the dissolution of uranium-plutonium alloys in bromine trifluoride. Activation energies between 10 and 12 kcal/mole were obtained. Details are included on the techniques and precautions employed in handling powdered plutonium compounds and plutonium hexafluoride. (auth)

53 BLG-20

Brussels. Centre D'Étude de l'Énergie Nucléaire.

STUDIE AANGAANDE DE CHEMISCHE ZUIVERING EN DE SCHEIDING VAN Zr/Hf MENGSELS (DEEL II) DE SCHEIDING VAN Zr/Hf MENGSELS. (Study Concerning the Chemical Purification and the Separation of Zr—Hf Mixtures. Part II. The Separation of Zr—Hf Mixtures. N. Issac and R. DeWitte. Mar. 15, 1958. 20p.

Two well-known separation methods were studied with three different liquid-liquid extraction columns to determine the possibility of using them for Zr production. A small quantity of nuclear pure ZrO_2 was produced from a product containing 2.5 to 3% HfO_2. It was proposed that a pilot-plant study be made of the H. C. Peterson-G. H. Beyer method for the separation of Zr and Hf. (tr-auth)

54 BNL-508

Brookhaven National Lab., Upton, N. Y.

THE NONDESTRUCTIVE ANALYSIS OF ANCIENT POTSHERDS THROUGH NEUTRON ACTIVATION. Edward V. Sayre, Alexander Murrenhoff, and Charles F. Weick. Apr. 1, 1958. 17p. $0.75(OTS).

The feasibility and the desirability of the nondestructive analysis of valuable archeological objects through neutron activation were investigated. Some pottery objects were completely irradiated in the Brookhaven Reactor, and some were exposed in part with the main bulk covered by a protecting Cd shield. In both cases the induced gamma-ray activity was compared to that produced in small samples of the corresponding specimens. It was possible to identify the presence of eleven elements in the potsherds by neutron activation analysis. It was demonstrated that the data obtained might indicate provenance and reveal routes of ancient commerce. (W.L.H.)

55 CF-58-9-69

Oak Ridge National Lab., Tenn.

STATUS REPORT ON HF AND UF_6 ADSORPTION EXPERIMENT. Mack Tyner. Sept. 2, 1958. 16p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A study of the adsorption of HF and UF_6 on NaF pellets in the presence and absence of nitrogen diluent was made. The adsorption reaction was studied in an adiabatic bed by means of thermocouples placed at known heights. Equations were written for the numerical calculation of compositions and adsorption rates as functions of height and time in the bed. Data from nine experiments on HF is available for numerical analysis. (auth)

56 JENER-Pub.-15

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

X-RAY AND NEUTRON DIFFRACTION STUDY OF CALCIUM HYPOPHOSPHITE AND PHOSPHOROUS ACID. Bert Onno Loopstra. 1958. 59p.

Calcium hypophosphite and phosphorous acid were investigated in order to establish by direct methods the shape of the $H_2PO_2^-$ and HPO_3^{2-} group and to find the length of the P-H bond in these groups. Both the x-ray and the neutron diffraction work was carried out. The JEEP (Joint Establishment Experimental Pile) at Kjeller, Norway, was used as the neutron source for the neutron diffraction work. (auth)

57 KAPL-M-ABR-6

Knolls Atomic Power Lab., Schenectady, N. Y.

SIGNIFICANCE OF WHITE CORROSION PRODUCTS ON ZIRCALOY. A. B. Riedinger. Sept. 4, 1958. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Corrosion products on Zircaloy are not desirable, but they are not necessarily indications of penetrating or catastrophic attack. The seriousness of the accelerated attack resulting in white corrosion products can frequently be determined by the appearance. The white corrosion products formed due to surface impurities have no effect on the structural strength of the Zircaloy but may seriously affect the heat-transfer characteristics or the amount of ZrO_4 released to the stream. (W.L.H.)

58 KAPL-M-DPS-1

Knolls Atomic Power Lab., Schenectady, N. Y.

DETERMINATION OF SILVER, CADMIUM, INDIUM, AND TIN IN SILVER BASE ALLOYS. D. P. Stricos and J. T. Porter, II. July 17, 1958. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A procedure was developed for the determination of Ag, Cd, In, and Sn in an alloy composed of these metals. The sample is dissolved in a mixture of nitric and fluoboric acids; the Ag and In determined polarographically in KI solution, and the Sn determined polarographically in ammonium chloride—hydrochloric acid. (auth)

59 KAPL-M-SMS-93

Knolls Atomic Power Lab., Schenectady, N. Y.

CHLORIDE ION ANALYZER. R. L. Seidel. Sept. 10, 1958. 35p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

A new Beckman silver-silver chloride pressed billet electrode has been employed in static and flowing systems to measure chloride ion concentrations in the range of 0.1 to 100 ppm. The chloride ion concentration has been measured within ± 0.1 ppm in a quiescent system, and within ± 0.2 ppm at flow rates up to 3 gal/hour in a loop containing water from the S3G Fresh Water Cooling System contaminated with from 0 to 45 ppm chloride ions. Calibration curves have been prepared for the new electrode used in combination with a non-mercury containing reference electrode and a model H-2 pH meter at temperatures ranging from 10 to 50°C. It is recommended that a small flow cell similar to that described in this report be installed in a bleed-off stream in the S3G Fresh Water Cooling System to continuously monitor the chloride ion content. Test results also indicate that the cell can be used to monitor chloride content of condensate from steam generators, and in laboratories as a quick chloride analysis. (auth)

60 NP-6955
Brussels. Centre D'Étude de l'Énergie Nucléaire.
KRISTALGEOMETRISCHE INTERPRETATIE VAN DE ETSPATRONEN EN GLIJBANDENKONFIGURATIE BIJ LITHIUM-FLUORIDE-EENKRISTALLEN. (Crystal-Geometric Interpretation of the Etching Patterns and Slip Band Configurations in Lithium Fluoride Single Crystals.) J. Schepers. July 8, 1958. 11p.

Slip band configurations, cleavage lines, slip planes, and orientations of the dislocations in lithium fluoride single crystals are illustrated. Origin of the indentation figure for slip planes at a point is shown. (J.S.R.)

61 NP-6956
Brussels. Centre D'Étude de l'Énergie Nucléaire.
RAPPORT DE MISSION. VISITE AUX CELLULES CHAUDES DE SACLAY—LE 10 JUIN 1958. (Trip Report—Visit to Hot Cells at Saclay—June 10, 1958.) R. C. De Beukelaer. July 24, 1958. 7p.

A description of the hot cells in construction at Saclay is given. The cells were originally scheduled to be in operation by the summer of 1958, but it will probably be later. (J.S.R.)

62 NP-6971
Brussels. Centre D'Étude de l'Énergie Nucléaire.
COMPTE RENDU DE LA QUATRIEME REUNION DU COMITE CONSULTATIF DE CHIMIE. (Proceedings of the Fourth Assembly of the Consultant Committee on Chemistry.) Includes papers: ANALYSIS BY ACTIVATION AND GAMMA SPECTROMETRY. J. Colard. NEUTRON ACTIVATION ANALYSIS. P. Schonken. Sept. 22, 1958. 6p.

The use of a pulse analyzer for activation analysis of trace impurities in liquids and solids is described. The application of neutron analysis to the determination of traces of Na and K in W and of Co in blood is also discussed. (J.S.R.)

63 NP-6977
California Inst. of Tech., Pasadena. Guggenheim Jet Propulsion Center.
THE APPARENT ORDER OF HETEROGENEOUS SPRAY REACTIONS. Report No. 27. F. A. Williams. Sept. 1958. 8p. Contract DA-04-495-Ord-446.

The order and rate of a heterogeneous reaction involving liquid or solid particles in a gaseous medium are sometimes measured in devices which produce steady flow of the heterogeneous mixture. The objective of this study is to show that the apparent order of the heterogeneous reaction (with respect to the material composing the particles) obtained in this manner is primarily a function of the particle size distribution and is largely independent of the single-particle reaction order. (W.L.H.)

64 NP-6979
Iowa State Coll., Ames.
ORGANO-METALLIC AND ORGANO-METALLOIDAL HIGH TEMPERATURE LUBRICANTS AND RELATED MATERIALS. Progress Report for June 30, 1958 to September 30, 1958. Henry Gilman, Bernard J. Gaj, and Oren L. Marrs. 37p. Contract AF33(616)-3610.

Experimental work continued with studies of reactions of triphenylsilyllithium with alkyl halides, aryl halides, metal halides, organomercury compounds, group V-B halides, and carboxylic acid derivatives. Also studied were silanes containing the benzyl or allyl group and their reactions, and reactions involving the azobenzene- and stilbene-dilithium adducts. (See also WADC-TR-53-426 (Pt. 5).) (T.R.H.)

65 ORNL-2202
Oak Ridge National Lab., Tenn.
SEPARATION OF AMERICIUM AND PROMETHIUM. R. S. Pressly. Mar. 27, 1957. 4p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

Promethium-147 is separated with the long-lived rare-earth fraction in the process of obtaining cesium-137 from radioactive waste material. Because of the fission yield of 2.6% and the half life of 2.6 years, there is contained in two-year decayed solution approximately equal activities of promethium-147 and cesium-137. Ion exchange methods of separating the individual rare earths separate promethium and americium together. These two activities are difficult to separate from each other. Ion exchange methods separate small quantities effectively. With larger quantities, the precipitation method described in this report has been used and has proved to be more efficient than ion exchange. By this method promethium and americium are coprecipitated as fluorides. This fluoride precipitate is dissolved in boric acid and HNO_3 solution. The resultant solution is made 3.0 M in hydrofluosilicic acid (H_2SiF_6), which, upon heating and slow digestion, decomposes into two volatile gases, HF and SiF_4. Promethium fluoride precipitates from the solution, and americium remains complexed in solution. (auth)

66 ORNL-2330
Oak Ridge National Lab., Tenn.
ISOLATION OF CARRIER-FREE Mn^{54} AND I^{125} FROM CYCLOTRON TARGETS. H. T. Russell. July 31, 1957. 3p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

Chemical processing for the recovery and purification of carrier-free I^{125} and Mn^{54} produced by bombardment of isotopically enriched Te^{125} and Cr^{54} with protons in the ORNL 86-inch cyclotron is discussed. The enriched Te^{125} and Cr^{54} were recovered for re-use. (auth)

67 ORNL-2558
Oak Ridge National Lab., Tenn.
DECLADDING OF PWR BLANKET FUEL ELEMENTS WITH AQUEOUS AMMONIUM FLUORIDE SOLUTIONS. L. M. Ferris. Oct. 9, 1958. 20p. Contract W-7405-eng-26. $0.75(OTS).

A flowsheet is presented for decladding PWR blanket fuel elements with boiling $6\ \underline{M}\ NH_4F-1.0\ \underline{M}\ NH_4NO_3$. After decladding, the pelleted UO_2 core is dissolved in $10\ \underline{M}\ HNO_3$ to produce a solution suitable for recovery of uranium by solvent extraction. A 30-mil Zircaloy-2 jacket can be completely dissolved in about 2 hr with a uranium loss of less than 0.02%. The total uranium loss after decladding and core dissolution was less than 0.022%. All experiments were performed with unirradiated fuel specimens. Ammonium nitrate was added to the decladding solution to dissolve the tin in Zircaloy-2 and thus prevent excessively high uranium losses (~0.8%) to a nitric acid—insoluble residue comprised mainly of SnO_2. Another solvent for tin, cupric chloride, caused higher uranium losses (0.13%) to the dejacketing solution. (auth)

68 UCRL-8356

California. Univ., Berkeley. Radiation Lab. DISSOCIATION ENERGIES OF GASEOUS OXIDES. Leo Brewer. July 1958. 4p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

Preliminary thermodynamic tabulations for gaseous oxides are presented. (J.R.D.)

69 AEC-tr-3306

DETERMINATION OF THE COMPOSITION AND INSTABILITY CONSTANT FOR OXALATE COMPLEXES OF Pu^{3+} COMPOUNDS BY ION EXCHANGE. A. D. Gel'man, N. N. Matorina, and A. I. Moskvin. Translated by the Oak Ridge National Lab. Library Staff from Atomnaya Energ. 4, 52-6(1958). 10p.

Using the ion exchange method, the complex formation of Pu^{3+} ions was investigated in oxalate solutions in the pH interval of 1.4 to 3.0. It was established that in the given pH region, complex ions are formed, $[Pu(C_2O_4)_2]^-$ and $[Pu(HC_2O_4)_4]^-$, the instability constants of which are in satisfactory agreement with those of the corresponding complex ion obtained by the solubility method. (auth)

70 AEC-tr-3392

RESEARCH ON THE SYSTEM ClF_3-HF. N. S. Nikolaev and I. M. Maliukov. Translated for Oak Ridge Gaseous Diffusion Plant from Zhur. Neorg. Khim. 2, 1587-90 (1957). 10p.

Polythermal analysis was used to study the ClF_3-HF system. Unlimited mutual solubility of ClF_3 and HF was established, and the eutectic system 44.0% ClF_3—56% HF was investigated. The equation for dissociation of ClF_3 in HF was determined. (J.R.D.)

71 AEC-tr-3398

THE ABSORPTION SPECTRUM OF THE $AuCl_4^-$ ION. A. A. Vlček and P. Beran. Translated for Oak Ridge National Lab. from Chem. Listy 50, 1306-7(1956). 4p.

The absorption spectrum of gold chloride in hydrochloric acid was measured on a Beckman DU spectrophotometer with a silicon prism at intervals of 5 mμ. The characteristics of an intense absorption band in the ultraviolet region are given and discussed with respect to the effect of addition of ethylene diamine. (T.R.H.)

72 AEC-tr-3399

INVESTIGATION OF THE SYSTEM $HF-ZrF_4-H_2O$ BY THE ISOTHERMIC SOLUBILITY METHOD (ISOTERM 0.5°). I. V. Tananayev, N. S. Nikolayev, and Iu. A. Buslayev. Translated by Lydia Venters (Argonne National Lab.) from Zhur. Neorg. Khim. 1, 274-81(1956). 13p.

The solubility of zirconium fluorides in hydrofluoric acid from 0 to 100% of HF at 0.5°C and the solid phases of the composition $ZrOF_2 \cdot 2H_2O$, $ZrF_4 \cdot 3H_2O$, $H_2ZrF_6 \cdot H_2O$, and ZrF_4 were determined. The procedure for the determination of fluorine and zirconium in combination and the reactions of thermal decomposition of $ZrOF_2$, $ZrOF_2 \cdot 2H_2O$, $ZrF_4 \cdot 3H_2O$, and $H_2ZrF_6 \cdot H_2O$ was studied. (auth)

73 AEC-tr-3400

DISTORTION OF THE CRYSTAL LATTICE IN SOLID SOLUTIONS. V. I. Iveronova, A. P. Zvyagina (Zviagina), and A. A. Katsnel'son. Translated by Lydia Venters Argonne National Lab.) from Kristallografiya 2, 414-18 (1957). 11p.

Mean quadratic atomic displacements of atoms are calculated on the basis of the elastic model of a solid solution. By the order of magnitude the experimental and calculated values of U_{st} coincide, but no parallelism with the difference of the atomic radii required by the theory was observed. The analysis of probable reasons for this deviation is given. The dependence of the value of mean quadratic atomic displacements on the concentration was investigated with Fe—Co, Ni—Cr, Ni—Ti, and Fe—C. At low concentrations the linear dependence d_{st} on concentration on all curves is observed, which agrees with the calculations made on the basis of the elastic model. A deviation from the theory in $\alpha = f(c)$ for the case of the Ni—Fe alloy was observed. At the same time it was found that the U^2_{st} values determined from x-ray photographs taken with cobalt or molybdenum radiations are different. A dependence curve of the characteristic temperature on concentration for the Ni—Fe alloys is plotted. The examples of the Cu_3Au and Ni_3Fe alloys show the dependence of the characteristic temperature on the long-range order. (auth)

74 AEC-tr-3401

CRYSTAL CHEMISTRY OF COMPLEX DIVALENT PLATINUM COMPOUNDS (EFFECT OF TRANSINFLUENCE IN CRYSTALLINE MATERIALS). G. B. Bokii and G. A. Kukina. Translated by Lydia Venters (Argonne National Lab.) from Kristallografiya 2, 400-7 (1957). 18p.

An x-ray structure investigation of compounds K_2PtBr_4, $K[PtNH_3Cl_3]$, $K[PtNH_3Br_3]$, $K[PtNH_3Cl_3] \cdot H_2O$, $K[PtNH_3Br_3] \cdot H_2O$, $K[PtC_2H_4Cl_3] \cdot H_2O$, and $K[PtC_2H_4Br_3] \cdot H_2O$ was performed. The plane of the ethylene molecule itself is perpendicular to that of the $[PtBr_3]$ group. In investigations on quadrivalent platinum compounds with the help of x-ray and optical methods it was proved that the nitro group possesses a weaker transinfluence than chlorine and bromine. (auth)

75 AEC-tr-3409

KINETICS OF OXIDATION OF SILVER BY MOLECULAR OXYGEN IN GASEOUS ELECTRIC DISCHARGE. V. V. Tyapkina (Tiapkina) and P. D. Dankov. Translated by Lydia Venters (Argonne National Lab.) from Doklady Akad. Nauk S.S.S.R. 59, 1313-15(1949). 6p.

The dependence of the oxidation rate of silver on its processing time in the electric discharge was studied in order to investigate the mechanism of the phenomenon of the formation of polymolecular oxide layer. The initial stage of the interaction between silver films in vacuum and the molecular oxygen was investigated. (auth)

76 AEC-tr-3411

A METHOD FOR DETERMINING THE TOTAL AND PARTIAL SATURATED VAPOR PRESSURES OF LIQUID BINARY MIXTURES OVER THE RANGE 0.1—10 mm Hg. S. I. Sklyarenko and Yu. U. Samson. Translated by Oak Ridge National Lab. Library Staff from Zhur. Fiz. Khim. 32, 1149-52(1958). 9p.

The vapor pressures of saturated vapors of individual substances in binary liquid mixtures were investigated. The technique of measurement and the experimental apparatus are described, including a specially constructed membrane manometer. (J.R.D.)

77 AEC-tr-3418

HETEROGENEOUS ISOTOPIC EXCHANGE BETWEEN LIQUID MERCURY AND MERCURY IONS IN AQUEOUS SOLUTION. D. G. Tuck. Translated for Phillips Petroleum Co. from J. chim. phys. 54, 896-901(1957). 11p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 6533. (J.E.D.)

78 AEC-tr-169

ELECTRICAL CONDUCTIVITY OF n-SEMICONDUCTORS WITH CHEMISORPTION OF ATOMS AND RADI-

CALS. M. A. Miasnikov. Translated for MIT, Lincoln Lab. from Doklady Akad. Nauk S.S.S.R. 120, 1298-1301 (1958). 9p.

The conductivity of ZnO and TiO_2 adsorbent-semiconductor as affected by sorption of hydrogen and nitrogen atoms and methyl radicals was higher than for C_2H_4, N_2, and H_2 molecules. The phenomenon may be used in detection and measurement of atoms and radicals. (T.R.H.)

79

PREPARATION OF A ThB(Pb^{212}) STANDARD. H. R. von Gunten (Univ. of Berne) and D. Ledent (Univ. of Brussels). Chimia Switz. 12, 146-7(1958). (In French)

The method used in the preparation of a ThB standard for use in absolute age determinations of thorium minerals is described in detail. The standard was prepared from a thorite of Kivu (Belgian Congo). (J.S.R.)

80

SPECTROPHOTOMETRIC AND POLAROGRAPHIC DETERMINATION OF RUTHENIUM IN OXALIC ACID. S. Mesaric and M. Branica (Inst. "Rudjer Boskovic", Zagreb). Croat. Chem. Acta 30, 81-7(1958).

A spectrophotometric and polarographic method is proposed for the determination of ruthenium tetroxide absorbed in oxalic acid. Spectrophotometric measurements of ruthenium in $1\underline{N}$ oxalic acid were made at 375 mμ. In the concentration range from 2 to 36 μg of ruthenium per ml the relative standard error amounted 14 to 1%, respectively. The polarographic determination was performed in a supporting electrolyte containing $1\underline{N}$ oxalic acid and 0.006% thymol (as a maximum suppressor). The determination is applicable in the concentration range from 4 to 120 μg ruthenium per ml with a relative standard error of 15 to 0.7%, respectively. Hydrochloric sulfuric, and perchloric acid up to $0.5\underline{N}$ does not interf . In the presence of nitric acid spectrophotometric and polarographic determinations of ruthenium are impossible. (auth)

81

POLAROGRAPHIC DETERMINATION OF RUTHENIUM IN CITRATES AND TARTRATES SOLUTIONS. M. Branica and S. Mesaric (Inst. "Rudjer Boskovic", Zagreb). Croat. Chem. Acta 30, 89-93(1958).

Polarographic methods are proposed for the determination of small amounts of ruthenium in two new supporting electrolytes: a. citric acid (0.3 $\underline{M}$) and sodium hydroxide (0.15 $\underline{M}$); b. tartaric acid (0.2 $\underline{M}$), sodium hydroxide (0.1 $\underline{M}$), and thymol (0.009%). Determination of ruthenium is applicable in the concentration range from 4 to 120 μg of ruthenium per ml with a relative standard errors from 15 to 0.8% in both electrolytes. Hydrochloric, sulfuric, and perchloric acids (up to 0.5 $\underline{N}$) do not interfere, but in the presence of nitric acid (any traces of nitrites) polarographic determinations are impossible. (auth)

82

THE CONSTITUTION OF POLYNUCLEAR DOUBLE-CHARGE URANIUM-OXYGEN COMPLEXES AND THEIR ARRANGEMENT IN THE WATER SOLUTION STRUCTURE. I. I. Lipilina (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 122, 238-41(1958) Sept. 11. (In Russian)

Polynuclear complexes with complex uranium-oxygen configurations, where the uranyl bond has two mutually perpendicular directions, are investigated. The cubic modification of UO_3 and $UO_2(OH_2)$ was considered as complexes of uranyl bonds with three mutually perpendicular spatial directions. (R.V.J.)

83

PRODUCTION AND PROPERTIES OF NIOBIUM IODIDE. D. M. Chizhikov and A. M. Grinko (Baikov Inst. of Metallurgy). Doklady Akad. Nauk S.S.S.R. 122, 278-9(1958) Sept. 11. (In Russian)

Niobium iodides were prepared by heating the metal up to 1300 to 1500°C in iodide vapor atmosphere. Niobium and iodide formed a series of compounds with NbI_5, NbI_3, and Nb_6I_{11} content. Microhardness of the iodide metal is about 64 to 80 kg/mm^2; recrystallization point is at 940°C. (R.V.J.)

84

RECOVERY OF BY-PRODUCT FLUORINE. Grady Tarbutton, Thad D. Farr, Thomas M. Jones, and Harry T. Lewis, Jr. (Tennessee Valley Authority, Wilson Dam, Ala.). Ind. Eng. Chem. 50, 1525-8(1958) Oct.

Practical methods for recovering fluorine compounds from effluent gas in phosphate processes and conversion of these compounds to useful products were investigated. Recovery as cryolite was encouraging in a plant-scale test producing specification grade material. Recovery as aluminum fluoride was evaluated, and recovery as hydrogen fluoride with a solid bed absorption method is described. (J.R.D.)

85

SYNTHESES OF METAL-COMPLEXING POLYMERS. I. PHOSPHORYLATED POLYMERS. J. Kennedy, E. S. Lane, and B. K. Robinson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Appl. Chem. (London) 8, 459-64(1958) July.

The syntheses of phosphorylated allyl ester monomers and polymers are described and some factors relevant to allyl ester polymerization are discussed. Successful phosphorylations of chloromethylpolystyrene (cross-linked with 2% divinylbenzene), polyvinyl chloride and cannel coal, by the use of phosphorus trichloride in conjunction with a Friedel-Crafts catalyst ($AlCl_3$) have been conducted, and a technique for phosphorylation of a phenol-formaldehyde resin matrix is described. Alkaline hydrolysis of triallyl phosphate and diallyl allylphosphonate polymers results in monobasic resins with a sodium-hydrogen exchange capacity of 4.5 milliequivalents/g of acid resin. Oxidative hydrolyses (contact with concentrated nitric acid) of the phosphorylated product obtained from the reaction of chloromethylpolystyrene with phosphorous trichloride results in a dibasic resin with an over-all exchange capacity of 8.5 milliequivalents/g. (auth)

86

SYNTHESES OF METAL-COMPLEXING POLYMERS. II. PHOSPHONAMIDE AND α-AMINOPHOSPHONATE POLYMERS. J. Kennedy and G. E. Ficken (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Appl. Chem. (London) 8, 465-8(1958) July.

A series of α-aminophosphonate resins containing the amphoteric complexing unit $-NR-CR-P(O)(OH)_2$ has been synthesized by various routes and shown to have adsorption capacities of the order of 1 to 2.5 milliequivalents/g of dry resin (sodium form) for cupric ions. Failure of diallyl phosphonamides and diallyl α-aminoalkylphosphonate esters to give solid polymers with conventional catalysts is noted. (auth)

87

VIBRATIONAL SPECTRUM AND STRUCTURE OF METAL-CYANIDE COMPLEXES IN THE SOLID STATE. IV. $K_3Cu(CN)_4$. Llewellyn H. Jones (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 29, 463-6 (1958) Sept.

The polarized infrared spectrum of single crystals of $K_3Cu(CN)_4$ has been observed. The fundamental frequencies of $Cu(CN)_4^{-3}$ under point group T_d have been assigned as 2094, 288, 324, 63, 2079, 364, 306, 74, and 250 cm^{-1}. From these frequencies, valence force symmetry force constants were calculated. Both the CN and CuC stretching force constants were found to be quite low (16.2 and 1.3 md/A, respectively). The CuC force constant, along with Badger's rule, gives a CuC distance of 2.05 A, somewhat shorter than the single bond distance of 2.12 A, predicted from the tetrahedral radii. (auth)

88

POLYMERIC GASEOUS MOLECULES IN THE VAPORIZATION OF ALKALI HALIDES. Joseph Berkowitz and William A. Chupka (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 29, 653-7(1958) Sept.

The molecular species of alkali halide vapors in equilibrium with their respective condensed phases have been deduced by a mass spectrometric analysis of the ions produced by electron impact. Dimers, trimers, and in some instances tetramers M_nX_n were observed, with the lithium halides exhibiting more dimeric than monomeric species. The results are in substantial agreement with earlier molecular beam velocity selector experiments, and discordant with some recent infrared spectral studies. Some oddities in the ionization efficiency curves are also discussed. (auth)

89

ON THE THEORY OF ELECTRONIC-VIBRATIONAL INTERACTION FOR RARE EARTH AND ACTINIDE SERIES IONS IN CRYSTALS. II. OCTAHEDRAL COMPLEXES. Robert A. Satten (Univ. of Calif., Los Angeles). J. Chem. Phys. 29, 658-64(1958) Sept.

A method is presented for obtaining the selection rules for transitions between shielded $4f^n$ or $5f^n$ states of rare earth and actinide ions coupled to lattice modes in crystals. This extends previous work which was limited to rigid vibrational motion of complexes in crystalline fields. The method is illustrated for ions in octahedral complexes at sites of either O_h or D_{3d} symmetry. It is clear from the examples how to apply to other complexes or to include interactions beyond the complex and thereby to obtain the effect of coupling lattice modes involving particles external to the complex. The method is contrasted with that applicable in the case of strong vibration-electronic interaction, i.e., to unshielded electronic states. (auth)

90

DIPOLAR BROADENING OF THE QUADRUPOLE RESONANCE LINE IN CRYSTALS $NaClO_3$, $NaBrO_3$. Kenji Kano (Kagawa Univ., Japan). J. Phys. Soc. Japan 13, 975-8(1958) Sept.

A few formulas have been derived for the contribution of the dipolar broadening to the second moment of the resonance line in pure quadrupole resonance experiment for crystals in which the following conditions are satisfied. All nuclear spins involved, both resonant and nonresonant, have spin $^3/_2$. The electric field gradient tensor at all nuclear sites have axial symmetry. For resonant nuclei the gradient of the electric field has the same magnitude but the symmetry axes of the electric field gradient at several nuclear sites in the unit cell have different directions. As for the nonresonant nuclei no restriction has been set the magnitude of the electric field gradient and its directions. A comparison is made with the line widths for $NaClO_3$ and $NaBrO_3$ observed by Kōi et al. (auth)

91

THE BEHAVIOR OF CALCIUM SULFIDE, SILICA, AND ALUMINUM OXIDE IN CALCIUM CARBIDE MELTS AT TEMPERATURES UP TO 2900°C. Robert Juza and Klaus Bünzen (Univ. of Kiel). Z. anorg. u allgem. Chem. 295, 334-48(1957). (In German)

Calcium carbide was heated with CaS, SiO_2, $CaSiO_3$, or Al_2O_3 up to temperatures of 2900°C. Calcium sulfide does not react with calcium carbide or carbon up to temperatures of about 2500°C. At 2850°C calcium sulfide and carbon combine to form CaC_2. Volatilization of sulfide begins at 2600° and is complete at 2800°C. SiO_2 is converted into SiC in fused calcium carbide. At 2600°C silicium sublimes free from the melt. $CaSiO_3$ reacts similarly. Al_2O_3 undergoes conversion into Al_4C_3 in a melt of calcium carbide. At 2750°C volatilization is almost complete. (auth)

92

DETECTION OF TUNGSTEN, MOLYBDENUM, VANADIUM, AND TITANIUM IN MINERALS ON EXCURSIONS. Otto Neunhoeffer (Humboldt Univ.). Z. anorg. u allgem. Chem. 296, 208-9(1958). (In German)

Oxidic minerals of W, Mo, V, Nb, and Ti can be decomposed by simple heating with metallic sodium in a small test tube. Solving in hydrochloric acid develops the characteristic colors of the lower oxidation stages of these metals. (auth)

93

REACTIONS BETWEEN NICKEL CHLORIDE, PHENYLLITHIUM, AND HYDROGEN. Brigitte Sarry and Werner Hanke (Martin-Luther Univ.). Z. anorg. u allgem. Chem. 296, 229-40(1958). (In German)

The reaction of anhydrous nickel chloride with phenyllithium dissolved in ether was investigated in an atmosphere of hydrogen. $NiCl_2$ is reduced by phenyl-lithium to elementary nickel which is produced in a highly active form; therefore, a very rapid catalytic hydrogenation is started. Independent of the presence of the nickel catalyst, phenyl-lithium reacts more slowly with hydrogen yielding lithium hydride and benzene. (auth)

94

PHOTOMETRIC DETERMINATION OF TANTALUM, BORON, INDIUM, AND RHENIUM. N. S. Poluektov, L. I. Kononenko, and R. S. Leuer (Inst. of General and Inorganic Chemistry, Odessa). Zhur. Anal. Khim. 13, 396-401(1958) July-Aug. (In Russian)

Simple and complex acids of elements which are well extracted by oxonium mechanism or as high molecular bases salts can be extracted, in a number of cases, as basic dyes salts. On the basis of this phenomenon, the new photometric methods for the determination of tantalum, boron, indium and rhenium have been developed. (tr-auth)

95

USE OF DIPHENYLCARBAZONE FOR THE PHOTOMETRIC DETERMINATION OF COPPER IN IRON AND STEEL. L. N. Lapin and N. V. Reis (Samarkand Medical Inst.). Zhur. Anal. Khim. 13, 426-9(1958) July-Aug. (In Russian)

A method was developed for the photometric determination of copper in iron and steel with the use of diphenylcarbazone. The copper derivative of diphenylcarbazone is insoluble in water but is well extracted with benzene and its homologues; the intensity of the red extract obeys Lambert-Beer's law. The reaction described is specific and highly sensitive. It permits the detection of the tenths parts of a microgram of copper. Iron is combined as soluble phosphate complex. The experimental error of the determination of copper in iron and steel does not exceed 4%. (tr-auth)

96

INFLUENCE OF TETRAVALENT VANADIUM ON THE REDUCTION OF URANIUM ON A DROPPING MERCURY ELECTRODE. Yu. V. Morachevskii and A. A. Sakharov (Zhdanov Leningrad State Univ.). Zhur. Anal. Khim. 13, 457-63(1958) July-Aug. (In Russian)

The presence of tetravalent vanadium in the solution results in increasing the limiting reduction current of hexavalent uranium. It is shown by the graphic analysis of polarographic waves that the increase of the wave is caused by the reaction of the oxidation of pentavalent uranium with tetravalent vanadium which occurs at the surface of the dropping electrode. The possibility of such a reaction is proved by amperometric titration and by studying the relation between the limiting current and temperature and hydrogen ions concentration. (tr-auth)

97

ANALYTICAL STUDY OF THE PRECIPITATION OF TETRAVALENT URANIUM WITH SODIUM HEXAMETAPHOSPHATE. I. P. Alimarian, E. P. Nikolayeva, and G. I. Malofeeva (Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 13, 464-8(1958) July-Aug. (In Russian)

Tetravalent uranium can be precipitated with sodium hexametaphosphate. The influence of different factors on the uranium precipitation was studied. It was established that uranium is precipitated completely from 3 N solution of perchloric acid. Small amounts of uranium can be completely isolated when co-precipitated with thorium. (tr-auth)

98

REACTION OF URANIUM WITH FERRON (7-IODINE-8-HYDROXYQUINOLINE-5-SULFONIC ACID). V. A. Mikhailov. Zhur. Anal. Khim. 13, 494-5(1958) July-Aug. (In Russian)

A color reaction of uranium with ferron is described. A mechanism of the reaction is suggested on the basis of absorption curves comparison. (tr-auth)

99

DETECTION OF URANYL ION. S. P. Onosova and V. E. Dmitriev (Kirov Ural Polytechnical Inst., Sverdlovak). Zhur. Anal. Khim. 13, 503(1958) July-Aug. (In Russian)

A method was developed for detecting uranyl ion in a solution containing Mg^{2+}, Mn^{2+}, Zn^{2+}, Ni^{2+}, Co^{2+}, Al^{3+}, Cr^{3+}, Fe^{3+}, Ce^{3+}, Pb^{2+}, Cu^{2+}, Cd^{2+}, Be^{2+}, Ti^{4+}, Zr^{4+}, Th^{4+}, VO_3^-, MoO_4^{2-}, WO_4^{2-}. The method permits the detection of 10^{-5} g/ml of uranium (limiting dilution 1 in 100,000) in the presence of large quantities of other elements. (tr-auth)

100

THE EFFECT OF SUBSTITUTING DEUTERIUM FOR HYDROGEN ON THE ULTRASONIC VELOCITY, REFRACTION AND VISCOSITY OF BENZENE. I. B. Rabinovich, V. I. Kucheryavii, and P. N. Nikolaev (Lobachevskii Gor'kii State Univ.). Zhur. Fiz. Khim. 32, 1499-1505(1958). (In Russian)

The ultrasonic velocity in and density of 50 and 91% deutero substituted benzene was measured over the range 10 to 60°C and its compressibility was calculated. Substitution of 90% of the benzene hydrogens by deuterium was shown to increase the free volume of the benzene by about 9%. Correspondingly the deutero product has a compressibility exceeding the ordinary benzol by 6%. It was found that 90% deuterium substitution for hydrogen in the benzene lowers its static polarization by about 0.5%. On this basis it was shown that the dispersion energy of the molecular interaction and the Van der Waals a constant are less by 0.4 and 0.6 respectively for the deutero product than for its hydrogen analog. Due to the fall in the zero energy of the carbon-hydrogen bond on substituting hydrogen for deuterium, the frequency of the electronic transition from the zero to higher levels increases, which in turn lowers the electronic polarizability. The viscosity was determined over the range 10 to 70°. The isotopic effect in general is in harmony with the published data.

101

THE ANODIC OXIDATION OF HYDROGEN UNDER PRESSURES UP TO 500 atm. Z. V. Nikolaeva and A. I. Krasil'shchikov (Inst. of Nitrogen Industry). Zhur. Fiz. Khim. 32, 1545-55(1958). (In Russian)

The anodic oxidation of hydrogen under pressure up to 500 atm was studied in NaOH solutions with electrodes of platinum, gold, silver oxide, iron, and cobalt and in H_2SO_4 solutions with electrodes of platinum and gold. It was found that the character of the process depends to a considerable extent on the degree of oxidation of the electrodic material. A linear dependence was observed in a number of cases between the potential and the current density of the hydrogen oxidation, which was explained by the formation of adsorption oxides on the electrode and their interaction with hydrogen. The dependence was examined between the adsorption of surface oxides and the electrode potential. (tr-auth)

102

CHEMICAL TRANSFORMATIONS IN THE SOLID STATE AT PRESSURES OF 50,000 kg/cm². E. V. Zubova and L. A. Karataeva (Lomonosov Moscow State Univ.). Zhur. Fiz. Khim. 32, 1576-9(1958). (In Russian)

Measurements of pressure dependence of shearing force is a convenient and sensitive method not only for bringing to light changes in crystal lattices, but for revealing chemical transformations in the solid state under pressure. The method was tested on the reactions of copper sulfide formation and lead oxide decomposition and extended to the formation of the sulfides of Ni, Co, Fe, and of the phosphides of Mg and Zn as well as to the decomposition of MnO_3. The explosion of sulfur under super pressures first observed by Bridgman was confirmed to be the result of its interaction with adsorbed oxygen. (tr-auth)

103

THE OSMOTIC AND ACTIVITY COEFFICIENTS OF RbCl, CsCl AND KI IN HIGHLY CONCENTRATED AQUEOUS SOLUTIONS. L. L. Makarov, K. K. Evstrop'ev, and Yu. G. Vlasov (Zhdanov Leningrad State Univ.). Zhur. Fiz. Khim. 32, 1618-21(1958). (In Russian)

A description is given of the isopiestic method of vapor pressure measurement. With the aid of this method determinations were made of the solubility of RbCl, CsCl, and KI at 25°C, 7.78, 11.41, and 8.89 M/1000 g H_2O respectively; and the osmotic and activity coefficients of RbCl, CsCl and KI from 5.0 or 5.5 M/1000 g H_2O to saturated solutions. (tr-auth)

104

EFFECTS OF γ RADIATION ON THE AQUEOUS SOLUTIONS OF AMMONIA AND SODIUM NITRATE. V. A. Sharpatyi, A. A. Zansokhova, and V. D. Orekhov (Karpov Inst. of Physics and Chemistry, Moscow). Zhur. Fiz. Khim. 32, 1686-7(1958). (In Russian)

The oxidation mechanism of ammonia in aqueous solutions was studied by means of conjugated acceptors of nitrate ion and molecular oxygen. Aqueous solutions of ammonia (0.15 M) and 1 M sodium nitrate saturated with oxygen or inert gases (N_2 or Ar) were irradiated by a Co^{60} γ source. Curves showing the dependence of NO_2^- ion yield on the pH of the solution at various irradiation conditions are presented. The scheme of ammonia oxidation in the presence of nitrate ion is expressed as: $90H^- + 1.5NH_3 + 1.5OH^- = 1.5NO_2^- + 7.5H_2O$. (R.V.J.)

Radiation and Radiochemistry

105 AERE-C/R-1575(1 to 6)Suppl.2

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

SELECTED ABSTRACTS OF ATOMIC ENERGY PROJECT UNCLASSIFIED REPORT LITERATURE IN THE FIELD OF RADIATION CHEMISTRY and BIBLIOGRAPHY OF THE PUBLISHED LITERATURE. Second Annual Supplement. (Papers noted up to December 1957.) R. W. Clarke, comp. 1958. 330p. $7.56(BIS).

This bibliography is the 1958 Supplement to the documents AERE C/R 1575 Parts 1 to 6 and consists of 1371 abstracts in the field of radiation chemistry. (W.L.H.)

106 HW-56769

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

KINETICS OF THE DECOMPOSITION OF ORGANIC REACTOR COOLANTS (thesis). D. R. de Halas. July 1958. 80p. Contract W-31-109-eng-52. $2.25(OTS).

Submitted to the Oregon State College.

The kinetics of the decomposition of several polyphenyl compounds were investigated under the influence of pyrolysis and radiolysis. It was found that all of the polyphenyl compounds investigated polymerized according to a first order rate law under the single influence of reactor radiation or gamma rays or pyrolysis. That is, the rate of polymerization was directly proportional to the amount of remaining unpolymerized material. When the polyphenyl material was simultaneously undergoing radiolysis and pyrolysis, the situation was found to be more complex. At moderate temperatures, 200 to 400°C, the pyrolysis of the polyphenyl was negligible compared to the radiolysis. However, in this temperature range the polymers formed by radiolysis were partially degraded by thermal action. The resulting rate law for polymerization includes a term for this back reaction. At higher temperatures, above about 400°C, the pyrolysis became the dominating reaction, and the effects of radiation could be neglected. It was found that all of the compounds investigated polymerized at almost identical rates under irradiation. However, there were notable differences in pyrolytic polymerization rates between the various polyphenyl compounds. Because pyrolysis is much more important than radiolysis at high temperature, the thermal stability of the coolants is the factor which determines the maximum temperature at which the coolant can be utilized. The compounds in order of decreasing thermal stability are: biphenyl, all three terphenyl isomers, monomethylbiphenyl, and monoisopropylbiphenyl. These studies also brought out differences in the decomposition products formed by radiolysis and pyrolysis. In general, the products formed during the former process were polymerized to a greater degree than those formed by pyrolysis. The products formed by gamma ray and neutron radiolysis were quite similar but showed minor differences in composition. The relative damaging power of neutrons and gamma rays was compared on the basis of the amount of polymerization caused by the absorption of a given amount of energy in the hydrocarbon. Fast neutrons were found to cause about 50 to 200 per cent more damage than that caused by the absorption of an equal amount of gamma ray energy. (auth)

107

PYROLYSIS OF Pu(IV) AND Pu(III) OXALATES. R. E. Kartushova, T. I. Rudenko, and V. V. Fomin. Atomnaya Energ. 5, 24-8(1958). (In Russian)

It is shown that freshly precipitated Pu(IV) oxalate loses three molecules of water. After 3 to 4 days an additional 1.5 to 2.7% of CO + CO_2 precipitates due to the disintegration of oxalate under Pu α irradiation at 110°C. Simultaneously, partial recovery of Pu(III) takes place. Two additional water molecules and 13% CO + CO_2 precipitate at 170 to 200°C with the recovery of Pu(III) in the initial $Pu_2(C_2O_4)H_2O$; at 380°C the oxalate transforms into PuO_2. At 140°C the oxalate of Pu(III) completely dehydrates and at 270°C in the atmosphere it transforms into PuO_2. In inert media at 330°C oxalate decomposes forming carbonate oxalate. At 460°C the carbonate oxalate decomposes and Pu(III) oxidizes into Pu(IV) with the formation of dioxide. (tr-auth)

108

SOME METHODS OF MASS PREPARING Po-α-Be NEUTRON SOURCES. G. S. Komaishko, V. I. Matvienko, et al. Atomnaya Energ. 5, 64-7(1958). (In Russian)

A wet method of preparing Po-α-Be sources based on a polonium and beryllium mixture prepared by conducting the polonium nitrate solution through a beryllium powder and drying and pulverizing the resulting mixture is described. The method of preparing copper-free polonium nitrate is also described. The wet method is not suitable for mass production of sources due to strong neutron activity in the basic technological process. A dry method is proposed for mass production in which copper powder, with a known quantity of Po^{210}, is weighed out into containers which are then filled with beryllium powder. The hermetically tight containers are then heated, sublimating Po^{210} and distributing it evenly in the mixture. (tr-auth)

109

THE CRYSTAL STRUCTURE OF THORIUM(IV) ACETYLACETONATE (A PRELIMINARY X-RAY EXAMINATION). D. Grdenić and B. Matković (Inst. "Rudjer Boskovic", Zagreb). Croat. Chem. Acta 30, 95-7(1958).

Single crystals of the thorium(IV) acetylacetonate were studied using x-ray methods. The crystals are monoclinic. The unit cell, which has the dimensions: $a = 11.67$ Å, $b = 12.69$ Å, $c = 16.95$ Å, $\beta = 112°15'$, contains four molecules. The space group is $C_{2h}^5-P2_1/C$. The Patterson synthesis allowed the preliminary x, z coordinates of thorium atoms to be determined. Further x-ray analysis is in progress. (auth)

110

THE EFFECT OF γ-RAYS FROM Co^{60} ON $Ca(NO_3)_2 \cdot 4H_2O$. A. S. Baberkin and M. A. Proskurnin. Doklady Akad. Nauk S.S.S.R. 121, 492-4(1958) July 21. (In Russian)

The behavior of inorganic crystallohydrates under the effects of irradiation was compared to the behavior of the anhydrous salts and concentrated solutions. Experiments used solid calcium nitrate $Ca(NO_3)_2 \cdot 4H_2O$ and a Co^{60} source with dose power 6.2×10^{19} ev/g per hr. (R.V.J.)

111

THE MECHANISM OF CROSS LINKAGE OF POLYMER CHAINS BY GAMMA-RADIATION. In Shen-kan, A. N. Pravednikov, and S. S. Medvedev (Karpov Research Inst. of Physics and Chemistry). Doklady Akad. Nauk S.S.S.R. 122, 254-7(1958) Sept. 11. (In Russian)

Radical reactions taking place in irradiated polymers, in particular the reaction with atomic hydrogen, were studied in order to determine the kinetics of the processes leading to the cross linking. The effects of temperature on the rate of linking were analyzed. Tabulated data show that the degree of linking increases with heating up to 90 to 95°C and decreases at temperatures of 140 to 145°C. On the basis of the data it was assumed that the formation of free radicals within the chain is the determining factor in the thermal destruction of polymers. (R.V.J.)

112

RADIATION-INDUCED CHLORINATION OF TOLUENE AND BUTYRIC ACID. Irving Rosen and John P. Stallings (Diamond Alkali Co., Painesville, Ohio). Ind. Eng. Chem. 50, 1511-12(1958) Oct.

Gamma and ultraviolet radiation induced chlorination of toluene and butyric acid was compared experimentally and with data in the literature. The products obtained from the ultraviolet and gamma initiated chlorination of toluene were about the same, and similar results were obtained for butyric acid. (J.R.D.)

113

A REMARK ON THE CHEMICAL KINETICS IN POLYMERS DURING IRRADIATION. Tsutomu Watanabe (Univ. of Toyko). J. Phys. Soc. Japan 13, 1063-4(1958) Sept.

It is concluded that the life time of a radical is pretty long ($10^2 \sim 10^4$ sec) in solid polymers, and it is not good to assume the stationary state. The long life time is also expected by the facts of graft copolymerization of gas phase monomers to the solid polymer after irradiation. As it has been measured that at 30 minutes after the cease of irradiation the graft copolymerization can take place in polyethylene, nylon, and polyvinyl alcohol, it is concluded that the conclusion is reasonable. (auth)

114

ON THE CHEMISTRY OF THE FISSION PROCESS IN REACTOR FUELS CONTAINING UF_4 AND UO_2. Mark T. Robinson (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 4, 263-9(1958) Sept.

Electrical neutrality must be maintained in nuclear reactor fuels. The consequences of this requirement are illustrated for two fuel materials: solid UO_2 and dilute solutions of UF_4 in molten fluorides. In both systems, changes with time of the valencies of several fission product elements are sufficient to maintain the necessary electroneutrality. In the molten fluorides, however, the situation is more complex than in the oxide, due to the possibility that certain fission product species may react with the container. The importance of rare gas removal in this regard is demonstrated. (auth)

115

THE BEHAVIOR OF FISSION PRODUCTS IN MOLTEN FLUORIDE REACTOR FUELS. Mark T. Robinson, William A. Brooksbank, Jr., Samuel A. Reynolds, Henry W. Wright, and Thomas H. Handley (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 4, 288-96 (1958) Sept.

Observations are reported on the behavior of several fission product elements in molten $NaF-ZrF_4-UF_4$ fuels, irradiated in capsule experiments, forced-convection in-pile loop experiments, and in the Aircraft Reactor Experiment (ARE). The rare gases were observed to escape readily from the fuels in dynamic tests, although in static tests the rate of escape is very low. Ruthenium and niobium deposit on the Inconel walls of the fuel container, probably as metals. Other fission products studied (Sr, Zr, La, Ce) appear to remain in the fuel. The results obtained are entirely consistent with theoretical predictions. It is suggested that the observed noble metal deposit may serve to reduce corrosion of metals by molten fluoride fuels. The unsatisfactory nature of Cs^{137} as a fission monitor in such fuels is reported and the use of Zr^{95} as a substitute is discussed. (auth)

116

THE USE OF RADIOACTIVE ISOTOPES IN STUDYING THE SPATIAL DISTRIBUTION OF ELEMENTS IN DIRECT CURRENT ARC PLASMA DURING SPECTROCHEMICAL DETERMINATION OF IMPURITIES IN URANIUM. E. E. Vainshtein and Yu I. Belyaev (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Moscow). Zhur. Anal. Khim. 13, 388-95(1958) July-Aug. (In Russian)

Active isotope distribution in the plasma was recorded in gamma rays by means of a pin-hole camera (camera-obscura) made of lead. The spatial distribution in the d-c arc plasma of atoms of various elements was proved to be different and to depend on volatility of elements. The causes of the effect of the carrier on the sensitivity of spectrochemical determination of impurities in uranium were ascertained. A symmetrical dome-like distribution of the atoms in the space of the arc, with a sharp maximum in the center is characteristic of the carrier, irrespective of the method of carrier introduction into the analytical gap of the arc. The carrier affects only the distribution of the elements in analytical gap of the source and brings about forced concentration of impurities in the central region of plasma in accordance with carriers distribution. The effect of the carrier is not of a selective nature. It may be considerably less when large amounts of elements with a spatial atom distribution differing from that of the carrier are present in the sample. (tr-auth)

117

MECHANISM OF ELECTROCHEMICAL REACTIONS ON A MERCURY CATHODE IN URANIUM SALT SOLUTIONS. G. S. Tyurikov, K. I. Rosental, and V. I. Veselovskii (Karpov Inst. of Physical Chemistry, Moscow). Zhur. Fiz. Khim. 32, 1490-8(1958). (In Russian)

Results are presented of polarographic studies on the mechanism of electrochemical reactions occurring in uranium salt solutions, using a dropping mercury electrode. Data are produced on exchange current measurements of the reactions: $UO_2^{2+} + \bar{e} \rightleftharpoons UO_2^+$ and $UO^{2+} + \bar{e} \rightleftharpoons UO^+$ on a stationary mercury electrode polarized by weak alternating currents. The main factors determining the character and rate of the electrochemical process taking place in acid solutions of uranium salts where hydrolysis has as yet not taken place were shown to be the laws governing the disproportionation of uranium and the related stability and steady state concentration, changing within wide limits. Measurement of the exchange currents of the electrodic reactions $UO_2^{2+} + \bar{e} \rightleftharpoons UO^+_2$ and $UO^{2+} + \bar{e} \rightleftharpoons UO^+$ yielded a value of 5 to 10 ma/cm^2. The dependence of the exchange current of these reactions on the potential and H^+ ion concentration follows from the slow discharge theory. (tr-auth)

Separation Processes for Pu and U

Refer also to abstract 486.

118 DP-294
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
A STABLE DILUENT FOR PUREX PROCESS EXTRACTANTS. Henry Pollock. June 1958. 8p. Contract AT(07-2)-1. $0.50(OTS).

The chemical stability and physical properties of n-dodecane make it a superior diluent for extractants such as are used in the Purex Process. The chemical stability of commercial n-dodecane can be increased by purification with synthetic zeolites (molecular sieves). (auth)

119 MCW-1418
Mallinckrodt Chemical Works, St. Louis.
URANIUM RECOVERY FROM SLAG BY FLUORIDE VOLATILIZATION. A PROCESS PROPOSAL. R. M. Edwards, J. A. Kennelley, and E. F. Sanders. Sept. 15, 1958. 28p. $1.00(OTS).

Laboratory and pilot plant studies are presented which indicate the technical feasibility of a uranium recovery process based on the reaction: $U_{(s)} + 3F_{2(g)} \rightarrow UF_{6(g)}$. Residual uranium in the fluorinated slag was in the range 0.14 to 0.20%. Reaction conditions were: feed rate: 100 pounds per hour; slag residence time: one hour; fluorine use: 1.4 times theoretical; temperature: 435 to 545°C. Economic analyses of the process are presented. (auth)

120
CHROMATOGRAPHIC SEPARATION OF RHENIUM AND TUNGSTEN. D. I. Ryabchikov and L. V. Borisova (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Moscow). Zhur. Anal. Khim. 13, 492-3(1958) July-Aug. (In Russian)

A method was developed for separating rhenium from tungsten on anionite with the use of 2 M H_3PO_4 solution. Separation of the elements is based on their different behavior toward phosphoric acid which forms complex anions with tungsten only; these anions are strongly held by the resin active groups. (tr-auth)

CONTROLLED THERMONUCLEAR PROCESSES

121 UCRL-5039
California. Univ., Livermore. Radiation Lab.
COLLAPSE—THE SHOCK HEATING OF A PLASMA. S. A. Colgate and R. E. Wright. Mar. 7, 1958. 10p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

In shock heating a body of plasma, the basic procedure is to apply a large pressure that rises in a short time compared to the transit time of sound across a plasma dimension. A large fraction of the energy input into a shock will produce irreversible heating, and this large and sudden heating is the objective. In the experiment described the geometry used is mirror, or axial field, and the shock is created by the sudden rise of an axial magnetic field. (W.D.M.)

122 UCRL-5102
California. Univ., Livermore. Radiation Lab.
INTERCHANGE INSTABILITY BY THE BOLTZMANN EQUATION. A. N. Kaufmann. Jan. 27, 1958. 7p. Contract W-7405-eng-48. $0.50(OTS).

The stability of a plasma, confined by an axially symmetric poloidal field, is studied for the case of low β and arbitrary field curvature by the use of the Boltzmann equation. A formal solution for the distribution function is obtainable as a power series in the oscillation frequency. By the use of perturbation theory a stability criterion is found, similar in form to that given by hydromagnetic theory but different in detail. (auth)

123 UCRL-5111-T
California. Univ., Livermore. Radiation Lab.
PROBLEMS OF OBTAINING THERMONUCLEAR TEMPERATURES. Richard F. Post. [nd]. 11p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

The problems associated with heating a plasma of ionized deuterium to thermonuclear temperatures are reviewed. Radiation losses are discussed. (W.D.M.)

124
ON THE NATURE OF ARC DISCHARGE IN INERT GASES. V. N. Egorov, V. N. Kolesnikov, and N. N. Sobolev. Doklady Akad. Nauk S.S.S.R. 121, 440-2(1958) July 21. (In Russian)

The thermal equilibrium of arc discharge plasma in an inert gas atmosphere was investigated. The distribution of excited levels and intensity lines of H, He, and Ne atoms was plotted. The results show that the thermal equilibrium is not present in the low-current arc column burning between the carbon electrods at normal pressures. (R.V.J.)

CRITICALITY STUDIES

125 BNL-486
Brookhaven National Lab., Upton, N. Y.
EXPERIMENTAL STUDIES OF SLIGHTLY ENRICHED URANIUM, WATER MODERATED LATTICES. PART I. 0.600-IN.-DIAMETER RODS. Herbert Kouts and Rudolph Sher. Sept. 1957. 41p. $1.25(OTS).

Studies on 15 uranium-water lattices of 0.600-in.-diameter uranium rods are presented. Three fuel enrichments were used; these had nominal U^{235} contents of 1.0%, 1.15%, and 1.3%. Actual enrichments and densities for the fuel is given. Five ratios of water-to-uranium volumes were studied with each fuel enrichment. The pertinent geometrical data on these lattices are given. (W.L.H.)

126 HW-56423
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
NUCLEAR SAFETY OF IRON-ENCASED FUEL ELEMENTS. N. Ketzlach. June 17, 1958. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A study was made of the reactivity of water flooded arrays of 0.95% enriched U^{235} fuel elements encased in aluminum and iron pipes. The feasibility of making large arrays of low U^{235} enrichment safe for shipping and storing was determined. Lattice calculations for solid and I and E fuel elements when bare, and encased in $\frac{1}{8}$ and $\frac{1}{4}$ inch pipe were made. Buckling measurements were made on 1.34 in. diam. solid rods in 0.049 in. thick iron pipe. (W.D.M.)

127 KAPL-M-NEF-4
Knolls Atomic Power Lab., Schenectady, N. Y.
ANALYSIS OF A PLASTIC MODERATED CRITICAL ASSEMBLY (PMA-3A) USING TWO METHODS OF CONTROL ROD REPRESENTATION. N. E. French and T. F. Ruane. June 27, 1958. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A plastic moderated critical assembly (PMA-3A) was used to compare calculational results with experiment. The annular core chosen contained eight boral cross rods which were represented in multigroup calculations by "thin-region" and "F-factor" methods. The two methods agree with one another and in turn agree within 1.4% ΔK of the experimental measurements. (auth)

128 ORNL-2201
Oak Ridge National Lab., Tenn.
TWO BERYLLIUM-MODERATED CRITICAL ASSEMBLIES. E. L. Zimmerman. Oct. 20, 1958. 66p. Contract W-7405-eng-26. $1.75(OTS).

Two unreflected critical assemblies using beryllium as the moderator and 93.4% enriched uranium metal as the fuel were built to provide a basis for the evaluation of certain reactor calculational procedures. Control and safety rods of the core-element-removal type were used in order that the final assemblies would not be complicated by strong absorber rods. In the first assembly (CA-1), which had outside dimensions of 21.0 × 21.0 × 23.3 in., the 0.01-in.-thick uranium disks were separated by 1-in.-thick blocks of beryllium, which gave a Be:U^{235} atomic ratio of 390 and a fuel loading of 18.08 kg of U^{235}. The extrapolated value of k_{eff} for the system was 1.0054. In the second assembly (CA-18), which had outside dimensions of 24.0 × 28.4 × 24.1 in., the fuel disks were separated by 4-in.-thick blocks of beryllium, which gave a Be:U^{235} ratio of 1560 and a fuel loading of 7.65 kg of U^{235}. For this assembly the extrapolated k_{eff} value was 1.0020. The observed uranium cadmium fractions in the two assemblies were 0.46 and 0.86, respectively. A number of multigroup calculations were made to evaluate the effects of various corrections and assumptions. It was concluded that the calculated neutron multiplication is very sensitive to the competition between leakage and slowing down at high energies, a range where fundamental data are uncertain. Without resolving the detailed neutron behaviors in this range, a reasonable selection of data within experimental uncertainties will give satisfactory values for such quantities as critical size. (auth)

129
DETERMINATION OF k_∞ FROM CRITICAL EXPERIMENTS WITH THE PCTR. D. J. Donahue, D. D. Lanning, R. A. Bennett, and R. E. Heineman (General Electric Co., Richland, Wash.). Nuclear Sci. and Eng. 4, 297-321(1958) Sept.

The PCTR is a seven-foot cube of graphite with a large cavity, 2 × 2 × 3 ft, located at its center. It is made critical by enriched uranium which is distributed on the boundary of the central cavity. One end of the assembly, 2 × 7 × 7 ft, is mounted on a movable cart, and can be moved away from the reactor proper allowing access to the central test region. The infinite medium, thermal neutron multiplication factor, k_∞, of a multiplying material is obtained by determining the amount of thermal absorber, which, when inserted with the multiplying material into the central region of the PCTR, will change neither the reactivity of the assembly nor the energy distribution of neutrons in it. The design of the reactor and the method used for determining this absorber mass are discussed and results for two graphite-natural uranium lattices are presented. (auth)

130
EFFECT OF ALLOYING ON THE CRITICAL MASS OF A PLUTONIUM SPERICAL FAST REACTOR. James T. Waber, Mary Repar Kline, and Leah K. Johnson (Los Alamos Scientific Lab., N. Mex.). Nuclear Sci. and Eng. 4, 341-53(1958) Sept.

The effect of alloying on the amount of plutonium required in forming a critical mass of each alloy is expressed in terms of an inventory requirement ratio, R_I. This quantity was obtained for twenty-seven potential alloying elements at three compositional levels. The effectiveness of using Vegard's law to estimate the density of the alloys was appraised by comparing the estimated densities and R_I values of nine intermetallic compounds with their x-ray densities and the R_I values computed from them. The parametric variation of R_I with f_T, the number of excess neutrons per collision was also studied. (auth)

131
CRITICAL MEASUREMENTS ON $UO_3-H_3PO_4$ SOLUTIONS. J. C. Allred, P. J. Bendt, and R. E. Peterson (Los Alamos Scientific Lab., N. Mex.). Nuclear Sci. and Eng. 4, 498-500(1958) Sept.

Critical measurements were carried out with solutions of UO_3(93.5% U^{235}) dissolved in 4.3 M H_3PO_4. A brief description of these measurements, their results, and an evaluation of some calculations are presented. (A.C.)

GEOLOGY AND MINERALOGY

132 NP-6970
Brussels. Centre d'Étude de l'Énergie Nucléaire.
CONTRIBUTION A L'ETUDE DE LA MINERALISATION RADIOACTIVE DE LA PEGMATITE DE KOBOKOBO ET DESCRIPTION D'UNE NOUVELLE ESPECE MINERALE RADIOACTIVE DE LA SERIE PHOSPHURANYLITE-RENARDITE: LA KIVUITE. (Contribution to the Study of the Radioactive Mineralization of the Kobokobo Pegmatite and Description of a New Radioactive Mineral Species of the Phosphouranylite-Renardite Series: the Kivuite.) L. Van Wambeke. July 1958. 25p.

Combined x-ray diffraction and fluorescence methods were used to discover a new mineral species, kivuite, in these studies of the pegmatite of Kobokobo. The radioactive minerals listed and discussed give an idea of the principal species occurring. Thorium was found associated with U^{6+} (curite—kivuite—phosphouranylite-renardite). (T.R.H.)

133 TEI-682
Geological Survey, Washington, D. C.
CHATTANOOGA SHALE AND RELATED ROCKS OF CENTRAL TENNESSEE AND NEARBY AREAS—AN ABSTRACT. Louis C. Conant and Vernon E. Swanson. June 1957. 12p. $3.30(ph OTS); $2.40(mf OTS).

The Chattanooga shale and Maury formation, which typically have a combined thickness of about 30 to 35 ft, crop out on the steep slope between the Nashville Basin and the surrounding Highland Rim; outside the Basin they are present in several river valleys and in folded areas. Throughout most of the area studied these rocks are nearly flat lying, but in the southeastern part they have been involved in the Appalachian folding and are commonly contorted and sheared. (auth)

134 TEI-683
Geological Survey, Washington, D. C.
RETENTION OF LEAD DURING OXIDATIVE ASHING OF SELECTED NATURALLY OCCURRING CARBONACEOUS SUBSTANCES. Frank Cuttitta and Jesse J. Warr, Jr. May 1957. 9p. $1.80(ph OTS); $1.80(mf OTS).

The amount of lead retained in the ash of lead-bearing carbonaceous material is essentially independent of the method of ashing. Samples containing lead in the range of 0.00X to 0.X % were ashed by ignition in a high-oxygen atmosphere and were also wet ashed. The lead in the ash was determined colorimetrically. Results were the same by both methods, but the time required is 3 to 10 times less for the dry-ashing method. (auth)

135

PYRITE-URANINITE POLYCRYSTAL. A. G. King (U.S. Geological Survey, Washington). Am. Mineralogist 42, 648-56(1957) Sept.-Oct.

A texture was observed in a sample of ore in which pyrite and uraninite occurred as thin alternate layers paralleling crystal faces of a pyrite nucleus. This texture could be formed either by replacement or by syntaxis. Although syntactic growth forming polycrystals of two chemically dissimilar minerals has not been previously described, this explanation fits the observed data better than the explanation offered by replacement. It is proposed, therefore, that this occurrence is an example of a polycrystal of uraninite and pyrite and that the mechanism of formation is syntaxis. (auth)

136

STUDY OF THE U/Th RATIO IN A THORITE FROM KIVU (BELGIAN CONGO) WITH REGARD TO ITS UTILIZATION IN THE PREPARATION OF THORIUM STANDARDS FOR GAMMA SPECTROMETRY. G. Poulaert (Univ. of Brussels). Chimia Switz. 12, 116-17(1958). (In French)

The uranium and thorium contents of a thorite from Kivu were determined. The very low U/Th ratio found makes this mineral a good standard for gamma spectrometry and for all other direct radiometric measurements of thorium. The mineral was used in the preparation of ThB standards for the determination of the absolute age of rocks and minerals. (tr-auth)

137

THE USE OF LEACHABLE URANIUM IN GEOCHEMICAL PROSPECTING ON THE COLORADO PLATEAU. II. THE DISTRIBUTION OF LEACHABLE URANIUM IN SURFACE SAMPLES IN THE VICINITY OF ORE BODIES. Heinrich D. Holland, George G. Witter, Jr., William B. Head, III, and Ruth W. Petti (Princeton Univ., N. J.). Econ. Geol. 53, 190-209(1958) Mar.-Apr.

Determinations were made of the leachable uranium content of soil and rock samples from the vicinity of the Standard-Lisbon-Cal Uranium ore body, Big Indian Wash, Utah, the new Monument No. 1 ore body, Oljetoh, Arizona, a Shinarump and a Chinle deposit near Cameron, Arizona, and the Freedom No. 1 and No. 2 ore bodies near Marysvale, Utah. In the sedimentary uranium deposits studied the presence of uranium mineralization can be detected at considerable horizontal distances from ore, but surface samples at vertical distances of more than about 30 ft from ore gave no indication of the presence of ore at depth. At Marysvale uranium was found to penetrate no farther than alteration visible in hand-specimen into the quartz monzonite wall rock of a uraninite-fluorite vein. Analyses of surface samples indicate that mineralization at the base of late Tertiary rhyolite can be detected at the surface through a fair thickness of rhyolite. The data as a whole suggest that in areas in which uranium ore is present at shallow depths leachable uranium analyses can serve as a useful tool in exploration. (auth)

138

PARAGENESIS OF SODIUM, POTASSIUM AND URANIUM IN VOLCANIC ROCKS OF LASSEN VOLCANIC NATIONAL PARK, CALIFORNIA. Andrew B. Vistelius (Lab. of Aeromethods, Academy of Sciences of USSR, Leningrad). Geochim. et Cosmochim. Acta 14, 29-34 (1958) Aug.

Statistical correlations between Na$_2$O, K$_2$O, and U in volcanic rocks at Lassen Park, California, (by the data published J. A. S. Adams) confirmed that the concentration of uranium in investigated rocks is not correlated geochemically with the process of fractional differentiation but is regulated by the migrations of uranium through the magmatic basin and its detention by the medium enriched with potassium. (auth)

139

BIOGEOCHEMISTRY OF THE RARE-EARTH ELEMENTS WITH PARTICULAR REFERENCE TO HICKORY TREES. W. O. Robinson, H. Bastron, and K. J. Murata (U. S. Geological Survey, Washington). Geochim. et Cosmochim. Acta 14, 55-67(1958) Aug.

Hickory trees concentrate the rare-earth elements in their leaves to a phenomenal degree and may contain as much as 2300 ppm of total rare earths based on the dry weight of the leaves. The average proportions of the individual elements (atomic percent of the total rare-earth elements) in the leaves are: Y 36, La 16, Ce 14, Pr 2, Nd 20, Sm 1, Eu 0.7, Gd 3, Tb 0.6, Dy 3, Ho 0.7, Er 2, Tm 0.2, Yb 1, and Lu 0.2. The similarity in the proportions of the rare-earth elements in the leaves and in the exchange complex of the soil on which the hickory trees grow indicates that the trees do not fractionate the rare earths appreciably. The variation of the rare-earth elements in the leaves and soils can be explained generally in terms of the relative abundance of the cerium group and the yttrium group, except for the element cerium. The large fluctuations in the proportion of cerium [Ce/(La + Nd) atomic ratios of 0.16 to 0.86] correlate with oxidation-reduction conditions in the soil profile. The substitution of dilute H$_2$SO$_3$ for dilute HCl in the determination of available rare-earth elements brings about a large increase in the proportion of cerium that is extracted from an oxygenated subsoil. These relationships strongly suggest that quadrivalent cerium is present in oxygenated subsoil and is less available to plants than the other rare-earth elements that do not undergo such a change in valence. A few parts per billion of rare-earth elements have been detected in two samples of ground water. (auth)

140

DETERMINATION OF THORIUM IN THE PARTS PER MILLION RANGE IN ROCKS. Harry Levine and Frank S. Grimaldi (U. S. Geological Survey, Washington). Geochim. et Cosmochim. Acta 14, 93-7(1958) Aug.

A procedure is presented for the determination of thorium in the concentration range of 0.2 to 10 parts per million ThO$_2$ in felsic or mafic rocks. Thorium is extracted by mesityl oxide and purified by iodate precipitation from nitric acid medium containing tartaric acid and hydrogen peroxide. The thorium is determined spectrophotometrically with thoron from meso-tartaric acid medium. (auth)

141

ARGON DETERMINATION IN POTASSIUM MINERALS. V. AGE DETERMINATION BY THE POTASSIUM-ARGON METHOD IN MINERALS AND ROCKS OF THE BLACK FOREST. W. Gentner and W. Kley (Univ. of Freiburg i. Br). Geochim. et Cosmochim. Acta 14, 98-104(1958) Aug. (In German)

This paper deals with systematic analyses of the foundation of the Black Forest according to the potassium-argon method. As this region has been well mapped, and as the sequence of ages of the petrogenetic main phases is known, there is a possibility of co-ordinating, in this region, the potassium–argon method with the mineralogical and geological examinations and to test at the same time the efficiency of the potassium–argon method. The measurements showed that an exact correspondence to the relative time scale could be attained and that the determination of age according to the potassium–argon method can be used to examine special problems of the petrogenetic evolution. (auth)

142

ARGON DETERMINATION IN POTASSIUM MINERALS. VI. THE GEOLOGICAL DEVELOPMENT OF THE BLACK FOREST PRIMITIVE ROCKS BY MEANS OF ABSOLUTE AGE DETERMINATION BY THE K–Ar METHOD. K. R. Mehnert (Freien Univ., Berlin). Geochim. et Cosmochim. Acta 14, 105-13(1958) Aug. (In German)

The age of 14 samples of variscian and prevariscian rocks of the Black Forest (Southern Germany) has been measured by means of the K–Ar method. The samples were taken in order of their petrogenetic sequence, which was known from previous petrographic work. The accuracy and precision of the method has been discussed for some granites, pegmatites, and porphyries of known age (lower/upper Carboniferous). The determined age of the metamorphic and granitized rocks depends on the time of the first formation of the original rock (i.e., sedimentary educt of paragneisses) but is strongly influenced by the age and intensity of the regional granitization (loss of Ar). This age has been determined as early-variscian. The age of the sedimentary educt is probably Pre-cambrian. (auth)

143

THORIUM IN IRON METEORITES: A PRELIMINARY INVESTIGATION. G. L. Bate, H. A. Potratz, and J. R. Huizenga (Argonne National Lab., Lemont, Ill.). Geochim. et Cosmochim. Acta 14, 118-25(1958) Aug.

By means of neutron activation analysis, thorium concentrations in two iron meteorites have been found in the approximate range of from 6×10^{-12} to 20×10^{-12} g Th/g meteorite. These values are lower by at least two orders of magnitude than previously determined levels of thorium concentration in irons. It is possible that the wide divergence of results must be attributed to differences in method, and evidence is presented in support of the validity of the method of neutron activation analysis. If Urey's calculated value for the distribution coefficient of thorium between iron and silicate phases is correct, the present thorium data seem to further substantiate the view that thorium in irons occurs primarily in inclusions or in thorium compounds dissolved in the iron. Comparison with uranium concentrations in irons recently determined by neutron activation analysis suggests moreover that if the thorium is accounted for by inclusions, these inclusions are not primarily silicate in nature; or if thorium is attributable to dissolved thorium compounds, the solubility of thorium compounds is less than that of uranium compounds in the original molten iron phase. (auth)

144

ABUNDANCE AND DISTRIBUTION OF URANIUM AND THORIUM IN ZIRCON, SPHENE, APATITE, EPIDOTE, AND MONAZITE IN GRANITIC ROCKS. Patrick M. Hurley and Harold W. Fairbairn (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Geophys. Union 38, No. 6, 939-44(1957) Dec.

Analyses were made of uranium and thorium in zircon, sphene, apatite, epidote, and monazite separated as accessory minerals from samples of granitic rock from widely scattered localities to indicate the abundance, and the natural distribution of these two components among the five mineral phases. The approximate distribution of the two elements in the accessory mineral phases, taken in pairs, is tabulated. (auth)

145

RECONNAISSANCE FOR RADIOACTIVE DEPOSITS IN SOUTHEASTERN ALASKA, 1952. Joseph R. Houston, Robert G. Bates, et al. U. S. Geol. Survey Bull. 1058-A. 35p. and 3 illus. Available from U. S. Government Printing Office for $0.75.

Reconnaissance for radioactive deposits in southeastern Alaska in 1952 was centered in three localities: the northern part of Prince of Wales Island and parts of adjacent islands, the Taku Harbor-Point Astley district, and the Hyder area. Significant concentrations of radioactive minerals were found only in the vicinity of Salmon Bay on the northeastern shore of Prince of Wales Island. In this area radioactive carbonate-hematite veins occur along the coast for about 8 miles. The veins are generally short, irregular, and lenticular, but a few can be traced for more than 300 ft between the low-tide line and the forest cover. The width of the veins normally ranges from less than 1 in. to 2.5 ft; several, however, are 5 to 10 ft wide. The most abundant minerals in the veins are dolomite-ankerite and alkali feldspar with decreasing amounts of red hematite, specular hematite, pyrite, siderite, magnetite, quartz, chalcedony, and chlorite. Parisite, bastnaesite, muscovite, fluorite, apatite, thorite, zircon, monazite, epidote, topaz, garnet, chalcopyrite, and marcasite have also been identified. Most of the radioactivity is due to thorium contained chiefly in the minerals thorite and monazite. The highest grade grab sample assayed 0.13% equivalent uranium or about 0.64% equivalent thorium. The average of 7 channel samples taken along 100 ft of one of the more radioactive veins was 0.034% equivalent uranium or 0.16% equivalent thorium. The rare-earth fluocarbonates parisite and bastnaesite, occur in small amounts in some veins. Four chip-channel samples taken from a high-grade rare-earth vein about 1,150 ft long averaged 0.79% rare-earth oxides over an average width of 7.4 ft. One high-grade grab sample from this vein assayed 5.0% rare-earth oxides. (auth)

146

BIBLIOGRAPHY AND INDEX OF LITERATURE ON URANIUM AND THORIUM AND RADIOACTIVE OCCURRENCES IN THE UNITED STATES. PART 5. CONNECTICUT, DELAWARE, ILLINOIS, INDIANA, MAINE, MARYLAND, MASSACHUSETTS, MICHIGAN, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, OHIO, PENNSYLVANIA, RHODE ISLAND, VERMONT, AND WISCONSIN. The Geological Society of America Special Paper 67. Margaret Cooper. New York, The Geological Society of America, 1958. 475p.

A bibliography is presented consisting of references to published literature, press releases, speeches, and both open-file and other unclassified reports dealing with U, Th, and radioactive occurrences in Conn., Del., Ill., Ind., N. H., N. J., N. Y., Ohio, Penna., R. I., Vt., and Wis. (J.E.D.)

HEALTH AND SAFETY

147 AERE-HP/R-737

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England. and Gt. Brit. Home Office. Civil Defence Dept., London.

THE HAZARD FROM INHALED FISSION PRODUCTS IN

RESCUE OPERATIONS AFTER AN ATOMIC BOMB EXPLOSION. A. C. Chamberlain and G. R. Stanbury. 1951. Decl. Apr. 18, 1958. 23p. (CD/SA-23).

148 HASL-42

New York Operations Office. Health and Safety Lab., AEC.

ENVIRONMENTAL CONTAMINATION FROM WEAPON TESTS. Oct. 1958. 370p. $3.50(OTS).

Included in this report are NYO-4753(Suppl. 2); A/AC.82/G/R; AERE-HP/R-2353; AERE-HP/R-2354; AERE-HP/M-126; and NYO-4889.

Data are presented pertinent to the monitoring of long-range fallout, particularly Sr^{90} and Cs^{137}. Values are tabulated for the fallout deposition, air concentrations, water concentrations, and the amounts in foods and human bone. In addition, results are given for some experimental investigations. The report of these results is not interpretative although certain papers that do attempt to interpret the present situation with respect to Sr^{90} in particular are reprinted. Bibliographies are included covering the period since the 1957 hearings before the Joint Committee on Atomic Energy concerning the nature of radioactive fallout and its effects on man. A document list of submissions to the United Nations Scientific Committee on the Effects of Atomic Radiation is given to illustrate the work done in other countries. Several papers on the subject, which have not been generally available, are reprinted. (C.H.)

149 NP-6983

Corps of Engineers.

DESIGN OF STRUCTURES TO RESIST THE EFFECTS OF ATOMIC WEAPONS. SINGLE-STORY FRAME BUILDINGS. Jan. 15, 1958. 236p. (EM-1110-345-417).

Methods and procedures are presented which were developed through the collaboration of many consultants and specialists for use in the design of structures to resist the effects of atomic weapons. This manual contains information for the guidance of engineers engaged in the design of permanent type single-story frame buildings for military use. The information is based on the results of full-scale atomic tests and analytical studies. Illustrative design examples are included. (C.H.)

150 NRL-4965

Naval Research Lab., Washington, D. C.

ATMOSPHERIC RADIOACTIVITY ALONG THE 80TH MERIDIAN, 1956. Interim Report. L. B. Lockhart, Jr., R. A. Baus, and I. H. Blifford, Jr. May 29, 1957. 16p. Projects NR-571-000 and NR-571-003. (AD-139007).

Measurements of atmospheric radioactivity and fallout at a number of sites along the 80th meridian (west) are reported for the year 1956. These results were obtained through the combined efforts of the U. S. Naval Research Laboratory and the Meteorological Services of Chile, Peru, and Ecuador with the cooperation of the U. S. Weather Bureau and the U. S. Atomic Energy Commission. Radioactivity levels at the various sites during 1956 are reported for three different collecting systems: air filters, cloth screens, and gummed films. Extremely wide variations in the gross radioactivity of fission products in the air have been noted, with the highest levels occurring in the Northern Hemisphere. The presence of some of the peaks of activity at various localities has been correlated with known atomic explosions. Radiochemical techniques are being developed for the routine analysis of collections for certain isotopes. Preliminary results of such analyses of a few filter collections indicate that the air at all of the collecting sites contains a greater proportion of the longer-lived fission products than would be expected in a young fission-product conglomerate. (auth)

151 ORO-176

Weather Bureau, Oak Ridge, Tenn. and Oak Ridge Operations Office. Research and Development Div., AEC.

ALIGNMENT CHARTS FOR SHAPE PARAMETERS OF ATMOSPHERIC DIFFUSION AND DEPOSITION PATTERNS. Frank Gifford, Jr. Sept. 1958. 8p. 2 illus. $0.50(OTS).

A series of four alignment charts is presented for use in determinations of shape parameters of atmospheric diffusion and deposition patterns of particular interest in connection with meteorological diffusion and fall-out computations. Construction of the alignment charts was based directly on Rosinski's 66 recently published Cartesian graphs of shape parameter values and follows standard nomographic principles. (C.H.)

152 UR-534

Rochester, N. Y. Univ., Atomic Energy Project.

A MULTIPLE CHAMBER EXPOSURE UNIT DESIGNED FOR CHRONIC INHALATION STUDIES. L. J. Leach, C. J. Spiegl, R. H. Wilson, G. E. Sylvester, and K. E. Lauterbach. Aug. 19, 1958. 29p. Contract W-7401-eng-49. $1.00(OTS).

To expose larger numbers of animals, primarily dogs and monkeys, in a five-year long inhalation study of uranium dioxide (UO_2), four separate chambers of the hexagonal type were combined in such a way that a common air intake and dust feed system can be used. The new multiple unit is described in detail and such engineering aspects as chamber design, selection of exposure equipment, and operational characteristics are discussed. (C.H.)

153 USNRDL-TR-253

Naval Radiological Defense Lab., San Francisco.

A WIND-MEASURING SYSTEM FOR TACTICAL FALLOUT PREDICTION. A. D. Anderson and W. E. Strope. Sept. 3, 1958. 28p.

A system which is capable of accurately measuring winds in the region of the atmosphere where fallout is occurring or will occur is essential for tactical fallout prediction. To do this, wind-sounding targets must be delivered rapidly to desired locations in the atmosphere and the wind data resulting from tracking these targets must be derived very quickly. Since current meteorological sounding equipment cannot normally meet these requirements, a new wind-measuring system is proposed that uses radar to measure the drift of falling passive targets delivered by rockets or gun projectiles. It appears feasible to develop an optimum system that can provide accurate wind data from regions of interest within a period of 10 minutes. (auth)

154 AEC-tr-3404

ATOMIC SHELTERS FOR THE MEDICAL SERVICE. (Abris anti-atomiques pour le Service de Sante). J. Tripod. Translated from Vjschr. schweiz. SaintOff 34, 262-9(1957). 9p.

Field fortifications are described which are designed to serve as shelters for medical units engaged in the emergency treatment of casualties during radiological warfare. Three of these earth and concrete shelters were built in an average of 480 man-hours each. (C.H.)

155

RADIOACTIVITY AND THE HUMAN SKELETON. Janeway Lecture, 1958. L. D. Marinelli (Argonne National Lab., Lemont, Ill.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 80, 729-39(1958) Nov.

Accumulated data on cases with a known exposure to radium or thorium are reviewed. Human data on the incidence of bone cancer in selected populations are compared with data on cancer incidence in mice injected with Sr^{90}. The validity of hypothetical extrapolation of data on tumor incidence is discussed. The importance is stressed of systematic collection and evaluation of data on the delayed effects of persistent low concentrations of any type of radioactive materials in the human skeleton. 43 references. (C.H.)

156
2nd REPORT OF THE FEDERAL COMMISSION FOR THE MONITORING OF RADIOACTIVITY. P. Huber. Atomenergie 2, No. 3, 13-21(1958) Sept. (In German and French)

The results of the monitoring of radioactivity in the air, fall-out, and the waters of Switzerland are reported and tabulated. (J.S.R.)

157
THE RELATIVE HAZARDS OF STRONTIUM 90 AND RADIUM 226. Margaret Hindmarsh, Maureen Owen, Janet Vaughan (Nuffield Dept. of Medicine, Oxford), L. F. Lamerton (Royal Cancer Hospital, London), and F. W. Spiers (General Infirmary, Leeds, Eng.). Brit. J. Radiol. 31, 518-33(1958) Oct.

A study has been made of the concentrations and linear dimensions of radium deposits in the skeleton of a man exposed to the risk of radium ingestion over a long period of adult life, and having a terminal body burden of 0.48 μg of Ra. Assuming deposits of Sr^{90} of the same sizes and relative concentrations as in the radium case, calculations have been made of the dose to soft tissues embedded in bone. Comparison has then been made of the dose from α and β particles under the same conditions of deposition. For the sites considered, the radiation dose non-uniformity factor for Sr^{90} varies from 0.9 to 3.1, while that for Ra varies from 1 to 16. A critical examination has then been made of the maximum permissible burden for Sr^{90}, at present based on a comparison with radium, using data from certain animal experiments. It is considered that this comparison is open to serious objection. It is also shown that a comparison of the maximum permissible burdens for those two isotopes on the basis of radiation dose presents many difficulties. It is suggested that the maximum permissible burden for Sr^{90} should be determined on a dosimetric basis without reference to radium. (auth)

158
FLASH BLINDNESS AND CHORIORETINAL BURNS PRODUCED BY ATOMIC FLASH. Victor A. Byrnes. J. Am. Med. Assoc. 168, 778-9(1958) Oct. 11.

Two separate, though related, conditions may be produced by atomic flash. One is flash blindness, a temporary incapacitation produced by visible light, and the other is retinal burn, produced by a combination of visible and infrared light. Their implications from a disaster standpoint are quite different. The pathology of each is discussed. (C.H.)

159
SIXTH HOT LABORATORIES AND EQUIPMENT CONFERENCE, MARCH 19-21, 1958, INTERNATIONAL AMPHITHEATRE, CHICAGO, ILLINOIS. [New York, American Institute of Chemical Engineers, 1958]. 375p. $10.00.

Radiochemical cells and process facilities in the United States and at a number of European establishments are described. Irradiation facilities and associated equipment in the United States are described. Hot laboratory practices and equipment, operation, and safety are discussed. (C.H.)

INSTRUMENTS

Refer also to abstract 488.

160 AERE-C/R-1764
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A DEVICE FOR GIVING CROSS MOTION ON A HILGER (L.76) MEASURING MICROSCOPE. L. F. H. Bovey and A. V. Slatter. Sept. 30, 1955. 6p.

Two modifications are described by which a photographic plate on a Hilger Comparator can be moved perpendicularly to the direction of the measuring screw. In one version this cross motion is controlled by a micrometer. (auth)

161 AERE-ES/R-2491
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A REMOTELY-OPERATED POLAROGRAPHIC APPARATUS. C. Jackson. Aug. 1958. 12p. $0.45(BIS).

Three simple pieces of apparatus are described which ease the problems of polarography on radioactive materials. The devices may be of use for other remotely-operated assemblies. (auth)

162 HW-56128
General Eletric Co. Hanford Atomic Products Operation, Richland, Wash.
AN AURAL ALPHA-BETA-GAMMA MONITOR. W. G. Spear and G. D. Crouch. June 1, 1958. 12p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

A compact, aurally-indicating, alpha, beta, gamma monitor was developed to permit simultaneous monitoring for surface contamination. The probe incorporates a combination zinc sulfide and terphenyl-in-polystyrene crystal detector. The alpha background is less than three c/m and the alpha detector will easily detect and indicate above background a Pu^{239} source at normal surveying probe speeds. The beta-gamma portion will detect C^{14} and S^{35} betas of 154 and 167 kev. (W.D.M.)

163 IGR-TN/CA-886
United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.
A DEMOUNTABLE VACUUM-TIGHT PIPE COUPLING WITH FACILITIES FOR REMOTE OPERATION. W. P. White. 1958. 22p.

A demountable vacuum-tight pipe coupling having facilities for remote operation is described. The coupling was developed for use with $\frac{1}{4}$ in. nominal bore pipes carrying gases or liquids at high temperatures. It is potentially suitable for use with larger pipes. (A.C.)

164 USNRDL-TR-251
Naval Radiological Defense Lab., San Francisco.
AN ELAPSED-LIVE-TIME CLOCK FOR THE PENCO PA-3 PULSE-HEIGHT ANALYZER. R. A. Taylor. July 1, 1958. 11p.

An instrument was designed and constructed to operate with the Penco PA-3 100-channel pulse-height analyzer which automatically measures the elapsed and live time of the analyzer. The analyzer counting time can be preset from either the elapsed-or live-time clock. (auth)

165 AEC-tr-3348
MEASURING TECHNOLOGY AND INFORMATION THEORY. Rezo Taryan. Translated for Oak Ridge National Lab. from Izmeritelnaya Tekh., No. 2, 22-5(1957). 11p.

An example is given demonstrating the theory of the use of signal reception at lower noise levels to increase accuracy of measurement. The process of measurement is analyzed, and it is pointed out that the basic problem of measuring small values is the determination of the amplitude of the signal. A method of measurement of signals with high noise level is presented, and by subtracting the energy of the noise level from the total, a true value of the quantity being measured can be determined. (J.R.D.)

166 SCL-T-196

SURVEY AND EVALUATION OF METHODS OF MEASURING THE HUMIDITY OF THE AIR. (Kratkiy Obzor i Otsenka Metodov Izmereniia Vlazhnosti Vozdukha). V. A. Usol'tsev. Translated by Marcel Weinreich (Sandia Corp.) from Nauch.-Issledovatel. Gidrometeorol. Priborostroenia, No. 4 (1957). 4p.

The optical-acoustical gas analyzer is described, along with its applications to humidity measurements of air. (J.E.D.)

167

IMPROVEMENTS IN THE DETECTION OF BETA PARTICLES BY COOLING THE PHOTOMULTIPLIER. J. Deutsch and P. C. Macq (Univ. of Louvain, Belgium). Ann. soc. sci. Bruxelles 71, No. 3, 172-7(1957). (In French)

A cooling device for photomultipliers is described; their response to anthracene scintillations is studied as well as their thermal noise in the range of temperature between −42°C and +23°C. The temperature coefficient of the response is found to be −0.18 ± 0.06%/°C. Consequently, in some cases, one might have to arrange for stabilizing the temperature of detection systems. The minimum energy required for electrons to be detected by an anthracene—RCA 5819 system can be decreased by approximately 50 kev if the photomultiplier is cooled down to about −40°C. (auth)

168

A CONVENIENT DROPPING FUNNEL FOR TRACER WORK. S. Kveder (Inst. "Rudjer Boskovic", Zagreb). Croat. Chem. Acta 30, 103-4(1958). (In Croatian)

A dropping funnel, having a ground-ball joint instead of a stopcock, is described. It proved to be very convenient for tracer work because of perfect sealing without greasing; the solution is in contact only with glass; all parts are easily disassembled and cleaned separately; and a relatively simple construction. (tr-auth)

169

LACUNOMETER: APPARATUS FOR SEMI-AUTOMATIC MEASUREMENT OF THE AVERAGE LENGTHS AND THE SPECTRA OF GAP LENGTHS IN NUCLEAR EMULSIONS. R. Weill, C. Joseph, M. Gailloud, and Ph. Rosselet (E.P.U.L., Lausanne, Switzerland). Helv. Phys. Acta 31, 546-50(1958). (In French)

The stage of the Koristka microscope M.S. 2 is driven by a phonograph motor. A cam moved by this motor produces electric pulses through a set of contacts. The pulses are transmitted by a morse key to a system which gives the mean value and the differential spectrum of gap lengths. The use of switching circuits and selectors enables one to build an apparatus much more simple and stable than those based on electronic devices. If the stage speed is kept at 0.4 μm/sec, the error on mean gap length is 1 to 2% for "plateau" track, and 3 to 4% for a four time greater blob density. (auth)

170

EXPERIMENTAL INSTALLATION FOR IRRADIATION OF ANIMALS BY A STREAM OF NEUTRONS (ENO-1). REPORT II. A. G. Istomina and I. B. Keirim-Markus. Med. Radiol. 3, No. 4, 69-75(1958) July-Aug. (In Russian)

An experimental apparatus with 200 c of Be−Po mixture for irradiation of small animals in uniform fast neutron field and methods for measuring the neutron flux are described. Distributions of slow and fast neutrons in the phantoms located in the chamber are plotted. (R.V.J.)

171

NEW METHODS OF IONIZING RADIATION DOSIMETRY. M. N. D'yachenko (Kharkov Inst. of Medical Radiology). Med. Radiol. 3, No. 4, 75-8(1958) July-Aug. (In Russian)

The relation between scintillator luminescence intensity and the hardness and length of x- and γ-ray waves was investigated, and the practicability of application of scintillators in dosimetry is discussed. The design is presented of a luminescence dosimeter consisting of a stilbene crystal and photomultiplier. (R.V.J.)

172

CALIBRATION OF A CALORIMETER: A MINOR PEACEFUL USE FOR PLUTONIUM. Rothschild (Univ. of Cambridge, Eng.). Nature 182, 789-90(1958) Sept. 20.

Plutonium-239 contained in platinum-iridium needles was used to calibrate a calorimeter. The actual energy output of the needles was measured at the National Bureau of Standards, Washington, D. C. (C.H.)

173

APPARATUS AND A LABORATORY FOR PROCESSING THICK NUCLEAR TRACK EMULSIONS. John F. Garfield (Brookhaven National Lab., Upton, N. Y.). Phot. Sci. Eng. 2, No. 2, 85-90(1958) Aug.

The special emulsions required in photographic studies in high-energy physics are considered, and the procedures for handling the emulsion pellicles and temperature control are given. The equipment for processing the emulsions is described. (J.R.D.)

174

ON DOCUMENTATION SYSTEMS FOR MOLECULAR SPECTRA. V. V. Nalimov and B. S. Neporent. Uspekhi Fiz. Nauk 65, 521-40(1958) July. (In Russian)

Documentation systems permitting selections of spectra by their characteristics are discussed, and various types of punch card systems are evaluated. (R.V.J.)

175

NEW MAGNETIC BETA SPECTROMETER. V. M. Kel'man. Vestnik Akad. Nauk S.S.S.R. 28, No. 7, 75-8 (1958). (In Russian)

A scheme is presented of a β spectrometer with improved resolving power based on separation of dispersing and focusing functions which are performed by different parts of the apparatus. The "magnetic prism" deflecting the electron beam is the principal improvement in the construction. Measurements of Ir^{192} conversion lines of γ quanta at 295.5, 308.5, and 316.5 kev, made on the improved spectrometer, are presented graphically. (R.V.J.)

176

A PAIR SPECTROMETER FOR THE MEASUREMENT OF A 30-Mev BREMSSTRAHLUNG SPECTRUM. Bernhard Ziegler (Technische Hochschule, Karlsruhe). Z. angew. Phys. 10, 397-403(1958) Sept. (In German)

A betatron bremsstrahlung spectra from a dense anode was measured with a magnetic pair spectrometer with good light intensity and approximately 2% resolution. The results were compared with the form of bremsstrahlung spectra obtained by Schiff (Phys. Rev. 83, 252 (1951)). (tr-auth)

177
X-RAY INTERFERENCE MEASUREMENTS WITH A PROPORTIONAL COUNTER AND A SINGLE CHANNEL DISCRIMINATOR. Adolf Trost. Z. angew. Phys. 10, 404-10(1958) Sept. (In German)

The construction and properties of the proportional counter and the discriminator are described in detail. The signal and initial current were at 50% channel width up to 10,000 imp/sec, at 20% up to 3,000 imp/sec, at 1% proportional to the intensity. The absorption sensitivity of the counter for copper K radiation amounts to 78%, the half-width of the impulse size distribution is only 11 to 15% of the average impulse size. Therefore, with a channel width of approximately 20%, one obtains a much better interference diagram than is obtainable with a scintillation counter. For molybdenum K radiation, the splitting in the counter into two different impulse sizes was suppressed with a special gas mixture, and therefore with an absorption sensitivity of 45% an acoustic sensitivity of 32% was obtained in the channel. The counters have a very long life, corresponding to 10^{11} collisions. (tr-auth)

178
AN AUTOMATIC RECORDING BALANCE. P. D. Kalinin and A. K. Kuznetsov (Inst. of Chemistry of Silicates, Leningrad). Zhur. Fiz. Khim. 32, 1658-60 (1958). (In Russian)

A description is presented of a balance with automatic recording of the changes in weight of a specimen in the process of its thermal treatment. The balance is designed according to the chain compensation principle using photoelements and a reversing motor. The transition from weight to emf changes recorded by an electronic potentiometer is accomplished by a potentiometric arrangement constantly controlled by a normal cell. (tr-auth)

179
A SUPERSENSITIVE U-SHAPED LIQUID MANOMETER. Ya. I. Kogan. Zhur. Fiz. Khim. 32, 1663-6(1958). (In Russian)

The design is given of an U-shaped manometer with widened bulbs. A very high sensitivity (up to 10^{-4} mm of the liquid column) is achieved by the use of colloid particles suspended in the liquid as indicator of the liquid movement in the connecting tube. Three methods of determining the pressure difference are indicated: by the value of the total shift of the particles along the tube axis; the initial velocity of the shift; from the volume of liquid compensating the shift. A highly sensitive level may also be designed on this principle. (tr-auth)

180
USE OF THE AUTOMATIC ELECTRONIC POTENTIOMETER EPPV -51 FOR A SCINTILLATION SPECTROGRAPH. A. N. Silant'ev (Khlopin Radium Inst., Leningrad). Zhur. Tekh. Fiz. 28, 1349-57(1958) June. (In Russian)

Descriptions are given of the design and performance of an improved gamma scintillation spectrometer. (R.V.J.)

METALLURGY AND CERAMICS

Refer also to abstract 489.

181 57-RL-1759
General Electric Co. Research Lab., Schenectady, N. Y.
LOW CROSS-SECTION IRON-BASE ALLOYS. D. W. Lillie. July 1957. 21p.

Data are presented on the mechanical properties of iron—silicon and iron—aluminum alloys in the range 0 to 14% Si and about 8% aluminum. The effect of third elements on ductility is discussed, and data are presented which indicate that it is not possible to obtain a disordered structure in Fe—Si alloys from 8 to 14% Si. It is concluded that alloys of iron with 6 to 8% aluminum offer a promising base composition for development of low neutron cross section alloys for use in nuclear reactors. (auth)

182 AERE-C/R-886
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE PROPERTIES AND MICROSTRUCTURE OF URANIUM DIOXIDE; THEIR DEPENDENCE UPON THE MODE OF PREPARATION. J. S. Anderson, E. A. Harper, S. Moorbath, and L. E. J. Roberts. Aug. 19, 1952. Decl. Feb. 24, 1956. 45p.

Uranium dioxide was prepared from a variety of starting materials by reduction with hydrogen or carbon monoxide at temperatures ranging from 500 to 900°C. The preparations were characterized by helium density measurements, surface area determinations, and x-ray diffraction. Many samples were examined under the electron microscope. A parallel set of preparations were indexed with Rd, Th and their emanating characteristics compared by determining the rate of escape of thoron as a function of temperature. The properties of the UO_2 preparations depended on the temperature of preparation and on the properties of the material from which they were prepared by reduction. Uranium dioxide of small particle size could only be prepared from small particle size material by reduction at low temperatures; considerable sintering of the primary particles took place below 900°C. Large particle size preparations of U_3O_8 always yielded large particle size UO_2 on reduction, and the density of the UO_2 depended on the density of the U_3O_8. The emanating-power experiments also illustrated the dependence of the microstructure of a UO_2 preparation on the nature of the parent substance. The bearing of the results on the mechanism of the reduction process is discussed. (auth)

183 AERE-READING LIST-4
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
METALLURGICAL ASPECTS OF ATOMIC ENERGY. A SELECTED READING LIST. P. J. Jones and G. L. Cooper. June 1958. 14p.

This report supersedes AERE-Inf/Bib-102.

The original list prepared in 1956 is brought up to date. The references are listed by author under the following headings: general, uranium, plutonium, thorium, beryllium, zirconium, niobium, ceramic materials, radiation effects, liquid metals, and radioactive tracers in metallurgy. (J.E.D.)

184 BM-IC-7830
Bureau of Mines, Albany, Oreg.
BIBLIOGRAPHY OF ZIRCONIUM. Eleanor Abshire. June 1956. 219p.

Supplement to BM-IC-7771.

A bibliography covering the current technical literature relating to the metallurgy of zirconium is presented. The material is divided into two sections—literature and patents. The bibliography contains 844 literature references and 62 patent references. Each section is arranged alphabetically by author, and a subject index is included. (J.E.D.)

185 BMI-1107
Battelle Memorial Inst., Columbus, Ohio.
THE PROPERTIES AND HEAT TREATMENT OF URANIUM–TITANIUM ALLOYS. David L. Douglass, Lyle L. Marsh, and George K. Manning. July 10, 1956. Decl. Sept. 6, 1956. 40p. Contract W-7405-eng-92. $6.30(ph OTS); $3.00(mf OTS).

The heat treatment and mechanical properties of three uranium–titanium alloys ranging in composition from 8.5 to 50 at. % titanium were investigated. The hardness of heat-treated alloys was correlated with microstructure and x-ray-diffraction results. From this study the following important observations were made: (1) a direct quench of gamma uranium–titanium solid solution resulted in the formation of a hard martensitic phase in low-titanium alloys, (2) subsequent tempering increased the hardness further by the rejection of a fine dispersion of U_2Ti, (3) similar hardness levels were obtained by isothermal transformation of an 8.5 at. % titanium alloy at 400 and 500°C, and (4) the crystal structure of the phases present at the solution-treating temperature, and the effect of temperature within a given equilibrium phase field, affected the hardness of both quenched and isothermally transformed alloys. (auth)

186 BMI-1280
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING JULY 1958. Russell W. Dayton and Clyde R. Tipton, Jr. Aug. 1, 1958. Decl. Oct. 7, 1958. 47p. Contract W-7405-eng-92. 48p. $7.80(ph OTS); $3.30 (mf OTS).

Data are given on the thermal conductivity of Ti–6 wt. % Al–4 wt. % V. The creep strength of 15% cold-worked Zircaloy-2 is being determined for reactor components in the 290 to 400°C range. Nine series of high-strength corrosion-resistant Zr alloys were prepared and corrosion tested. Results are included. The fabrication of Al–U alloys for uses in various reactors is presented. The development of a natural–U fuel alloy with improved corrosion resistance is presented. Results of corrosion tests on the natural–U alloy are presented. A study is presented to investigate the possibilities of applying a thin protective coating of Mo on the interior surfaces of the reactor system by electroless and vapor-plating techniques. An irradiation-damage program to determine the extent of damage to type 347 stainless steel in fast-neutron fluxes in the core of the ETR is presented. The properties of the high-niobium portion of the Nb–U constitution diagram are presented. The development of Th–U alloys with increased irradiation stability and corrosion resistance is presented. Dispersion-type fuel specimens containing 24 wt. % fully enriched UC and UN dispersed in a 18 wt. % Cr–14 wt. % Ni–2.5 wt. % Mo–balance Fe matrix and clad with type 318 stainless steel were fabricated for irradiation testing. Gas-pressure bonding is being investigated as a technique for the cladding and bonding of Nb and Mo fuel elements. Corrosion testing of Ti in Darex Process dissolver solution is presented. Studies were continued on ways of preventing stress-corrosion cracking of Carpenter 20 Cb in the Sulfex-Thorex system. A run is under way in a new molten-salt composition (62 $\underline{M}$ % NaF–38 $\underline{M}$ % ZrF_4). Specimens of INOR-1 and INOR-8, Hastelloy B, and type S-816 are being tested. A program is presented for the preparation of as-cast irradiation-test specimens of UC and the determination of some physical properties of UC. The post-irradiation examination of twelve Th–11 wt. % U specimens irradiated in two capsule trains has been completed. Creep data are presented on thermally degassed fine-grained sintered Ta sheet tested at 1200°F in a He atmosphere. A program to investigate the effects of reactor radiations on clad graphite specimens is in progress. The current work on the Nuclear Merchant Ship Reactor Program is primarily concerned with the development of fabrication techniques for UO_2-containing fuel pins for a dynamic loop test at the MTR. (For preceding period see BMI-1273.) (W.L.H.)

187 CF-58-7-132
Oak Ridge National Lab., Tenn.
QUARTERLY REPORT OF THE SOLUTION CORROSION GROUP FOR THE PERIOD ENDING JULY 31, 1958. J. C. Griess, H. C. Savage, R. S. Greeley, J. L. English, S. E. Bolt, S. R. Buxton, D. N. Hess, P. D. Neumann, E. S. Snavely, W. C. Ulrich, and N. E. Wisdom. July 31, 1958. 36p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

A number of loop runs have been made to determine the chemical stability of possible fuel solutions, and the results obtained from these runs have been compared with data obtained by others. A solution containing 0.04 m UO_2SO_4, 0.03 m $CuSO_4$, 0.03 m $NiSO_4$, and 0.023 m D_2SO_4 in heavy water was not completely stable at 175°C or at other higher temperatures. About 7% of the copper was lost at 175 to 275°C, and an additional 9% was lost when the temperature was increased to 300°C. In the same solution the nickel solubility decreased by 40% up to 200°C and then increased up to 275°C and at 300°C again decreased. Throughout the run no uranium was lost from solution. A second solution containing 0.01 m UO_2SO_4, 0.02 m D_2SO_4, 0.01 m $CuSO_4$ and 850 ppm nickel in heavy water was stable at 300°C. However, when an additional 450 ppm of nickel was added to the solution, about 10% of the uranium, 6% of the copper, and 20% more nickel than was added in the final addition precipitated from solution. Several other runs were made in which 0.04 m UO_2SO_4 solutions containing 0.025 m D_2SO_4, 0.03 m $CuSO_4$, and 0.04 m alkali or alkaline-earth metal sulfates were circulated at 300°C in a titanium loop. Solutions containing lithium and rubidium sulfate lost 30 and 15% of their copper, respectively. The loss of copper from solutions containing either beryllium or magnesium sulfate was no greater than 5%. Other runs with the latter two solutions in stainless steel loops showed that the beryllium-containing solution was more corrosive and the magnesium-containing solution less corrosive than the same solution without the added sulfate salt. Previous runs in stainless steel loops have shown that the removal of oxygen from uranyl sulfate solutions results in the precipitation of uranium and severe corrosion of the stainless steel. An attempt was made to minimize corrosion in such cases by the addition of magnesium sulfate to the solution prior to precipitation. No beneficial effect due to the presence of magnesium sulfate was observed. Experiments designed to determine the corrosiveness of the heavy-liquid phase of a uranyl sulfate solution above its separation temperature showed that titanium and Zircaloy-2 were only very slightly attacked by the heavy phase. Type 347 stainless steel, on the other hand, was attacked at a high rate. Tests that were previously reported showed that the rate of attack of carbon steel by boiler water at 300°C was proportional to the oxygen concentration in the range of < 1 to 10 ppm. Runs made under identical conditions except the solution containing 50 ppm of chloride have shown the chloride ions to be without effect on the corrosion of carbon steel. However, some stress-corrosion cracking of austenitic stainless steel specimens was observed in the presence of chloride ions. The ability of ruthenium, either as a salt, oxide, or metal, to catalyze the oxidation of chromium (III) to chromium (VI) in sulfuric acid solutions was demonstrated. Since chromium (VI) inhibits corrosion in sulfuric acid solutions, ruthenium can be classed as a corrosion inhibitor although its action is an indirect one. Previously the same effect of ruthenium was demonstrated in uranyl sulfate solutions. Whether ruthenium functions in the same manner during in-pile corrosion tests remains to be seen. The removal of oxygen from chloride-containing water at 300°C has prevented cracking of type 347 stainless steel during 2000-hr tests. With oxygen present in similar environments, 100% of the specimens tested underwent cracking in 500 hr or less. The pre-exposure of type 347 stainless steel stress specimens in boiling, chloride-free uranyl sulfate solution was 100% effective in preventing stress-corrosion cracking in a similar environment containing 50 ppm of chloride. In the absence of the pre-exposure, 55% of the specimens tested in the chloride-containing environment cracked. Prefilming in uranyl sulfate solution at 125, 150, 175, and 200°C has also been completely effective in preventing cracking in the boiling, chloride-containing solution. The corrosion resistance of Nionel was nearly comparable to that of type 347 stainless steel in several reactor-related environments. Its apparent immunity to cracking in chloride-containing uranyl sulfate makes its use especially attractive. Flame-Plate, a hard-facing material, and also type 202 stainless steel in a sensitized condition were found to be unsatisfactory for service in uranyl sulfate solutions. The corrosion resistance of CD-4MCu, a cast, age-hardenable alloy, was excellent in reactor-related environments. The alloy was tested in a number of heat-treated conditions, and in all cases corrosion rates were 0.7 mpy or less. Of particular interest was the fact that the alloy was not subject to cracking in boiling uranyl sulfate solution containing 50 ppm of chloride. The data presented in this report are, for the most part, preliminary and the interpretation of the results may change as further experimentation is completed. (For preceding period see CF-58-4-131.) (auth)

188 CF-58-9-37
Oak Ridge National Lab., Tenn.
EXAMINATIONS OF SPECIMENS AND SCALES TAKEN FROM THE HRT FOLLOWING RUNS 13 AND 14. G. H. Jenks, A. R. Olsen, and W. C. Yee. Sept. 11, 1958. 17p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

Following HRT runs 13 and 14, several metallic specimens were removed from the high pressure system and transferred to the Materials Section for examination. Samples of scale accumulation in the high pressure system were also taken after these runs and transferred to the Materials Section. Examination and analyses of these several specimens are still in progress, but some of the results are available and are reported. A possible interpretation of some of these results indicates that a considerable quantity of nickel was contained in the core scale accumulation at the end of run 13, and that part of this nickel was dissolved in solution during run 14. The amount of nickel which may have come from this source during run 14 roughly accounts for all of the increase in nickel in solution during run 14. A significant amount of uranium was also found in the scale accumulation in the core after run 13. (auth)

189 CF-58-9-75
Oak Ridge National Lab., Tenn.
FUEL RESOURCES, TYPES OF FUELS, AND FABRICATION. J. W. Ullmann. Sept. 29, 1958. 64p. Contract W-7405-eng-26. $10.80(ph OTS); $3.90(mf OTS).

To be presented at Power and Industrial Div., N. Y. Section, American Institute of Electrical Engineers Meeting in New York, N. Y., on Oct. 14, 1958.

The preparation of typical fuel elements is briefly described. (auth)

190 DMIC-Memo-1
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
THERMAL PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. J. W. Holladay. Aug. 25, 1958. 23p.

Available data from the files of the Defense Metals Information Center on the thermal properties of titanium and titanium alloys are presented. The properties covered are thermal conductivity, thermal expansion, heat capacity, thermal diffusivity, and emissivity. Methods are given for estimating values for these properties when experimental data are not available. (auth)

191 HW-51853
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PLUTONIUM FUELS DEVELOPMENT—PLUTONIUM METALLURGY OPERATION QUARTERLY REPORT [FOR] JANUARY, FEBRUARY, MARCH 1957. O. J. Wick. Sept. 5, 1957. 21p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

The Pu-bearing fuel elements and flux-monitoring disks were completed. The nominal composition of the alloys furnished was Al–1.8 wt. % Pu. Unbonded capsules with welded Zircaloy-2 jackets and containing fuel cores of Al–1.65 wt. % Pu and Al–12 wt. % Si–1.65 wt. % Pu alloys are being prepared for irradiation testing in the MTR. Rolling tests have been initiated to determine the workability of dispersion-type, Pu-bearing fuel materials, in particular, the more corrosion resistant alloy of Al, Si, and Pu. (W.L.H.)

192 HW-51854
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PLUTONIUM FUELS DEVELOPMENT—PLUTONIUM METALLURGY OPERATION QUARTERLY REPORT [FOR] APRIL, MAY, JUNE 1957. O. J. Wick. Nov. 14, 1957. 26p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

Four Zircaloy-clad capsules with Al–1.65 wt. % Pu and Al–12 wt. % Si–1.65 wt. % Pu alloy fuel cores were fabricated. The specimens were irradiated at the MTR and are awaiting return for examination. Analysis of data from Al–Pu alloy rod prepared for PCTR tests showed that segregation was present. X-ray diffraction measurements were made on differently prepared samples of PuO_2–UO_2 mixed crystals to establish the number of phases present. A defected, Zircaloy-clad capsule with an Al–1.5 wt. % U–1 wt. % Ni–0.5 wt. % Fe alloy core was autoclaved in 300°C water. The cladding developed a single circumferential crack and suffered minor dimensional changes. Fabrication of pins, wafers, and discs for PCTR tests was initiated. The flux-monitoring pins and wafers are to be Al–3.9 wt. % Pu alloys. Precision drilled discs of U–Pu alloy which simulate high exposure U are required. (For preceding period see HW-51853.) (W.L.H.)

193 HW-53333
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
INTERIM REPORT ON THE CORROSION OF ALUMI-

NUM AND STAINLESS STEEL BY TURCO 4306-B CLEANER. B. Griggs. Oct. 31, 1957. 4p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Corrosion tests were conducted on Al and stainless steel by Turco 4306-B cleaner before this cleaner was used on the rear face plumbing of the H Reactor. Results show that this cleaner was corrosive to both stainless steel and Al. (W.L.H.)

194 HW-54365
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PLUTONIUM FUELS DEVELOPMENT—PLUTONIUM METALLURGY OPERATION QUARTERLY REPORT—JULY, AUGUST, SEPTEMBER, 1957. O. J. Wick. Jan. 10, 1958. 36p. Contract [W-31-109-Eng-52]. $6.30(ph OTS); $3.00(mf OTS).

Four Zircaloy-clad unbonded capsules containing Al–1.65 wt. % Pu and Al–12 wt. % Si–1.65 wt. % Pu alloy were irradiated in the MTR. One capsule of each received 15 to 25% and 60 to 70% burnout of the Pu atoms. Two eleven-inch long, four-rod clusters containing Al–8 wt. % Pu and Al–12 wt. % Si–8 wt. % Pu alloy cores are being prepared for irradiation in the high temperature (235°C) KER Loop Facility. Experiments on the vacuum injection casting of aluminum fuel materials directly into cans have commenced. Mechanical pressure injection is being investigated as a fuel element fabrication method. Extrusion of Al have been made successfully. A defected capsule containing Al–1.5 wt. % U–1 wt. % Ni–0.5 wt. % Fe was exposed to 350°C water for 24 hours. Three PCTR test assemblies containing Pu impregnated graphite fuel material was fabricated. (For preceding period see HW-51854.) (W.L.H.)

195 HW-54879
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
STRESS, CREVICE, GALVANIC, AND UNIFORM CORROSION OF AUSTENITIC STAINLESS STEELS AND CARBON STEEL IN HIGH TEMPERATURE BOILER FEED WATER: A LITERATURE REVIEW. R. B. Richman. Feb. 6, 1958. 12p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

A bibliography of 89 references on stress, crevice, galvanic, and uniform corrosion of stainless and carbon steel in high temperature boiler water is presented. (W.L.H.)

196 HW-55045
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A SIMPLE GRAPHICAL METHOD FOR COMPUTING IN-REACTOR CORROSION TEMPERATURES. R. L. Dillon. Feb. 19, 1958. 8p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

A graphical method is described for estimating the corrosion temperature for fuel elements under irradiation. (auth)

197 HW-55415
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PLUTONIUM FUELS DEVELOPMENT—PLUTONIUM METALLURGY OPERATION QUARTERLY REPORT [FOR] OCTOBER, NOVEMBER, DECEMBER, 1957. O. J. Wick. Mar. 20, 1958. 33p. Contract [W-31-109-Eng-52]. $6.30(ph OTS); $3.00(mf OTS).

Data are given on the status of irradiation testing of Al–1.56 wt. % Pu and Al–12 wt. % Si–1.56 wt. % Pu alloy capsules in the MTR. Four-rod clusters containing Al–8 wt. % Pu and Al–12 wt. % Si–8 wt. % Pu alloy cores in Zircaloy jackets are being prepared for irradiation in the high-temperature (250°C) KER Loop Facility. Corrosion properties of the Zircaloy tubing and the end cap welds are being evaluated in the out of pile loops. Work is continuing on the development of air-pressure injection casting techniques for the fabrication of Al–Pu fuel elements. A development program to determine the feasibility of mechanical pressure injection casting or die casting Al–Pu alloy fuel elements of PRTR size and quality is progressing. Pyrometallurgical techniques are being investigated as a means of reconstituting irradiated Pu fuel materials through concentration of a Pu-bearing phase from the principal alloying elements. A small extrusion press was put into operation to determine the hot and cold extrusion characteristics of Pu and its alloys. Compacted billets of blended mixtures of aluminum powder and UO$_2$ were hot extruded bare and also coextruded in aluminum alloy jackets. Radiation effects are being determined on UO$_2$–PuO$_2$ mixed crystal fuel materials. Corrosion tests are being conducted on Al alloys using U as a stand in for Pu. The problems of heat transfer, corrosion, flow characteristics, and thermal cycling of the 19-rod cluster fuel elements are being studied. (For preceding period see HW-54365.) (W.L.H.)

198 HW-56152
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
MELTING POINT DETERMINATION FOR ALUMINUM ALLOYS A-1, A-2, C-1, AND C-2. J. C. Tverberg and J. E. Flinn, Jr. May 26, 1958. 9p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The purpose of this study was to determine the melting points and temperature arrest points of the NPR aluminum alloys. (W.L.H.)

199 IGR-TN/W-905
United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.
EQUIPMENT FOR THE MACHINING AND TENSILE TESTING OF IRRADIATED URANIUM. D. Shaw and W. G. Hufton. Apr. 30, 1958. 14p. $0.54(BIS).

A small center lathe was set up for turning tensile test pieces from irradiated uranium fuel elements. A Hounsfield Tensometer has also been modified for remote operation. The apparatus was commissioned and one tensile test carried out on irradiated uranium. In this instance the proof stress was increased from 25 to 34 tons per square inch and the elongation reduced from 4 to 0.3% compared with unirradiated uranium. (auth)

200 ISC-1047
Ames Lab., Ames, Iowa.
TABULATION, BIBLIOGRAPHY, AND STRUCTURE OF BINARY INTERMETALLIC COMPOUNDS. IV. COMPOUNDS OF ZINC, CADMIUM, AND MERCURY. R. M. Stanton, P. F. Woerner, C. L. Vold, J. A. Kingston, and J. F. Smith. Aug. 1, 1958. 50p. $1.25(OTS).

The fourth compilation in a series is presented. The three preceding reports (ISC-795, ISC-812, and ISC-906) contain similar information concerning Li, Na, K, Rb, Be, Mg, Cu, Ag, and Au. (J.R.D.)

201 KAPL-1908
Knolls Atomic Power Lab., Schenectady, N. Y.
DEVELOPMENT OF FERRITIC STAINLESS STEEL–UO$_2$ DISPERSION FUEL ELEMENTS. W. K. Barney, W. E. Ray, and H. G. Sowman. Jan. 30, 1958. 20p. Contract W-31-109-eng-52. $0.75(OTS).

A preliminary definition of a fabrication process for ferritic stainless steel–UO$_2$ fuel clad with Type 430 stainless steel has been achieved. The procedure is an adaptation of an earlier process for preparing austenitic fuel elements, and consists of the cold-binder extrusion of a plastic powder dispersion which is fired in dry hydrogen, fitted with welded end caps, and electroplated with nickel. This core is inserted into a length of Type 430 stainless steel cladding and the assembly is bonded by hot-swaging at 800°C. The irradiation performance of such a fuel element was examined by means of an MTR test. The results of this test strongly indicated that the desired lowering of UO_2 particle operating temperature was realized and that ferritic stainless steel is not unduly susceptible to irradiation damage. (auth)

202 KAPL-1929

Knolls Atomic Power Lab., Schenectady, N. Y.

HAFNIUM METAL POWDER BY THE HYDRIDE-DEHYDRIDE PROCESS. R. N. Honeyman and C. T. Waldo. May 6, 1958. 21p. Contract W-31-109-Eng-52. $0.75(OTS).

A method for making hafnium metal powder by the hydride-dehydride technique is explained. The process was proven by the manufacture of 150 lb of high quality powder. Limited tests indicate excellent corrosion resistance in parts made from this powder. Photographs of major equipment and tables listing typical gas contamination are included. (auth)

203 KAPL-M-AEB-3

Knolls Atomic Power Lab., Schenectady, N. Y.

ATTEMPT AT IDENTIFICATION OF SECOND PHASE IN ZIRCALOY-3 BY THE MICROEMISSION X-RAY SPECTROGRAPH. A. E. Bibb. Aug. 1958. 11p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

An investigation was conducted to identify the globular second phase observed in various Zircaloy metallographic specimens. This second phase was observed in both Zircaloy-2 and -3 and does not appear to be a function of the tin content of the alloy. (auth)

204 KAPL-M-AEB-4

Knolls Atomic Power Lab., Schenectady, N. Y.

EFFECT OF SURFACE CONDITION ON THE RATE OF HYDROGEN PICKUP IN ZIRCALOY-2. A. E. Bibb and A. H. Alberts. Aug. 1958. 7p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The investigation was designed to determine the effect of various chemical surface conditioning treatments on the relative rate of hydrogen pickup during batch hydriding of Zircaloy-2. (auth)

205 KAPL-M-RLM-16

Knolls Atomic Power Lab., Schenectady, N. Y.

MODULUS OF ELASTICITY OF ZIRCALOY-2 BETWEEN ROOM TEMPERATURE AND 1000°F. R. L. Mehan. July 3, 1958. 10p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The dynamic moduli of elasticity were obtained for Zircaloy-2 between room temperature and 1000°F. It was found that the modulus decreased linearly with temperature and that a difference existed between longitudinal and transverse specimens. Reasonable agreement was obtained between these moduli and static values obtained on the same material. (A.C.)

206 KAPL-M-SMB-4

Knolls Atomic Power Lab., Schenectady, N. Y.

FABRICATION HISTORY OF UNIVERSAL CYCLOPS B^{10}-STAINLESS STEEL INGOT KB 918. S. M. Bishop and W. J. Gregg. June 23, 1958. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The extrusion on the Universal Cyclops B^{10}—stainless steel ingot KB-918 into wire is described in detail. (W.L.H.)

207 NMI-4356

Nuclear Metals, Inc., Cambridge, Mass.

POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period October 17, 1957 through November 17, 1957. J. L. Klein, A. M. White, S. Isserow, P. D. Corzine, R. G. Jenkins, and D. F. Kaufman. Dec. 3, 1957. 33p. Contract AT(30-1)-1565. $6.30(ph OTS); $3.00(mf OTS).

The fabrication of Zircaloy-clad natural U tubular fuel elements of a quality suitable for irradiation testing at Savannah River and at Chalk River is presented. A second experimental lot of six full-sized tubes was extruded. Close attention was given to the post-extrusion operations of pickling, etching, and diffusion heat treatment. (W.L.H.)

208 NMI-4910

Nuclear Metals, Inc., Cambridge, Mass.

ALUMINUM-CLAD, URANIUM—ALUMINUM CORE TUBES FOR NRU REACTOR. I. B. Roll. Mar. 17, 1958. 15p.

The fabrication of a pair of nested Al-clad, U—Al alloy cored tubes having the nominal dimensions 8-foot core length, 10-foot 3-inch over-all tube length, 2.12 inch and 1.46 inch outside diameters, 0.03 inch cladding thickness, and 0.06 and 0.07 inch core thickness for the outer and inner tubes, respectively, is presented. (W.L.H.)

209 NP-6968

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

RESEARCH AND DEVELOPMENT OF BRAZING ALLOYS FOR HIGH-TEMPERATURE APPLICATIONS AND RESISTANCE TO OXIDATION. Quarterly Progress Report No. 2 [for] July 1, 1958 to September 30, 1958. Robert Necheles and Harry Schwartzbart. Oct. 1958. 12p. ARF Project No. B-146. Contract AF33(616)5654.

The second quarter of work has been completed on a program which has as its objective the development of oxidation-resistant brazing alloys containing temperature depressants which can be volatilized during vacuum brazing. The temperature depressant may also enhance wettability. The result of the vacuum brazing operation should be a joint with a higher remelt temperature than that at which it was made. Work during this period consisted mainly of vacuum brazing T-specimens with a number of filler metals containing temperature depressants. Remelt temperatures are now being determined for these specimens. No conclusions have yet been reached concerning the feasibility of this approach. (auth)

210 NP-6972

Clevite Research Center, Cleveland.

RESEARCH ON THE LUBRICATION OF TITANIUM. Quarterly Progress Report No. 8 [for] June 15, 1958 to September 15, 1958. N. Fatica. Sept. 15, 1958. 22p. Project No. 50167-G. Contract AF33(616)-3350.

The comparison of the relative wear rates of various metal-lubricant systems in the crossed cylinder machine has been made on a volume loss basis derived from wear scar measurements. Different materials systems are characterized by a specific wear rate constant, K. The experimental results obtained to date show a range of specific wear rates differing by 20,000:1. Six different titanium alloys have been evaluated in the crossed cylinder tester using Halocarbon 11-14 as the lubricant at loads ranging from 5 to 60 kg. The specific wear rate depends on the load to some extent but in general the value of K for the best titanium alloys was still 300 times as great as that obtained for electroless nickel in Mobil oil SAE 30. The latter wore about 50% as fast as Steel 52100 in the same lubricant. The similarity between Shell Four ball test results and crossed cylinder tests is discussed and verified in eight different cases. (auth)

211 ORNL-2495
Oak Ridge National Lab., Tenn.
PROGRESS REPORT ON VOLATILITY PILOT PLANT CORROSION PROBLEMS TO APRIL 21, 1957. L. R. Trotter and E. E. Hoffman. Oct. 17, 1958. 41p. Contract W-7405-eng-26. $1.25(OTS).

Many complex corrosion problems have been encountered in the preliminary bench tests and early operation of the Fused-Fluoride Volatility Process. Several of the problems have been investigated and are fairly well understood, such as embrittlement of nickel by sulfur-containing fluoride salts and the heavy attack on even the most promising structural materials by fused fluoride salts in the presence of air contamination at elevated temperatures. The heavy attack encountered on nickel rods in the fluorination vessel during early test runs is not completely understood, although it is believed that improved handling techniques and maintenance of a gas-tight system will reduce the attack. This report merely serves to emphasize that in a complicated high-temperature system of this type there are many material and design problems which must be solved before reliable long-time operation can be assured. (auth)

212 SC-4203(TR)
Clevite Research Center, Cleveland.
PIEZOELECTRIC CERAMIC MATERIALS. Final Report [for] February 1, 1957 to January 31, 1958. Don Berlincourt. Apr. 15, 1958. 110p. For Sandia Corp. Contract [AT(29-1)-789]. $16.80(ph OTS); $5.70(mf OTS).

This report summarizes research done by Clevite Research Center for Sandia Corporation during the period February 1, 1957 through January 31, 1958. The research was concentrated primarily on solid solutions of lead titanate and lead zirconate, but was expanded to include plain lead titanate, modified by off-valency additions, and lead metaniobate. Subjects of this study include response to high compressive stress, dielectric breakdown, pyroelectric and thermal measurements, and crystal growth. (auth)

213 SCTM-298-58(16)
Sandia Corp., Albuquerque, N. Mex.
ELEVATED TEMPERATURE PROPERTIES OF 2024-T3 ALUMINUM ALLOY. Donald R. Adolphson. Sept. 16, 1958. 22p. Contract AT(29-1)-789. $0.75 (OTS).

A compilation of available elevated temperature data for 2024-T3 aluminum alloy is presented. Included are mechanical and thermal data. Besides the variable of temperature, the effects of time at temperature, rate of loading, and rate of heating are included. (auth)

214 SCTM-299-58(16)
Sandia Corp., Albuquerque, N. Mex.
ELEVATED TEMPERATURE PROPERTIES OF 7075-T6 ALUMINUM ALLOY. Donald R. Adolphson. Sept. 16, 1958. 23p. Contract AT(29-1)-789. $0.75(OTS).

A compilation of available elevated temperature data for 7075-T6 aluminum alloy is presented. Included are mechanical and thermal data. Besides the variable of temperature, the effects of time at temperature, rate of loading, and rate of heating are included. (auth)

215 SCTM-300-58(16)
Sandia Corp., Albuquerque, N. Mex.
ELEVATED TEMPERATURE PROPERTIES OF 2014-T6 ALUMINUM ALLOY. Donald R. Adolphson. Sept. 16, 1958. 22p. Contract AT(29-1)-789. $0.75 (OTS).

A compilation of available elevated temperature data for 2014-T6 aluminum alloy is presented. Included are mechanical and thermal data. Besides the variable of temperature, the effects of time at temperature, rate of loading, and rate of heating are included. (auth)

216 UK/C/6/126
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
HIGH TEMPERATURE CORROSION TESTS ON ALUMINUM-NICKEL ALLOYS HTP LOOP TESTS OF HOT-PRESSURE WELDS AND VARIOUS LOOP FACTORS. [Paper Presented at] Sixth UK/Canada Technical Conference, Chalk River, Ontario, October 21-22, 1957. P. G. Anderson, G. J. Biefer, and F. H. Krenz. July 1957. 36p. (DR-689).

A number of corrosion tests were carried out on Al-Ni sheathing in the HTP out-reactor loop and in the X-2 loop of the NRX Reactor under typical conditions for a reactor fuel element. Results showed that the Al-Ni sheathing corrosion rates under these conditions were unacceptably high. (W.L.H.)

217 AEC-tr-3383
FACTORS INFLUENCING CREEP OF METALS. J. J. de Jong. Translated for Atomics International from Ingenieur (Utrecht) 64, No. 28, 92-101(1952). 32p.

A literature survey was made on the various factors which influence creep in metals. Information is summarized. (C.H.)

218
METAL STUDIES ON Pu, U AND THEIR ALLOYS. A. A. Bochvar, S. T. Konobeevskii, et al. Atomnaya Energ. 5, 5-23(1958). (In Russian)

A review is given of metallographic studies of nuclear fuels of Pu, U, and their alloys made in U.S.S.R. in connection with nuclear energy development. Descriptions are given of Pu properties and regularities in its interactions with other elements according to their position on the periodic table. Some properties and the behavior of U in thermal cycling and irradiation are discussed in relation to alloying and thermal and mechanical treatment. The methods of U treatment by pressure are investigated. Effects of neutron bombardment on the structure and properties of metals and their alloys are also analyzed. (tr-auth)

219
SOME OBSERVATIONS OF THE CORROSION OF UBi_2 AND $CeBi_2$ DISPERSED IN BISMUTH AND OF UPb_3 IN LEAD. P. J. Barton (Imperial Coll., London) and G. W. Greenwood (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Chemistry & Industry, No. 26, 830-1(1958) June 28.

Results indicate that the rapid corrosion of UBi_2, $CeBi_2$, and UPb_3 is due to water or water vapor and that atmospheric corrosion can be reduced by decreasing the relative humidity. It appears that a matrix which is ductile in tensile tests may be quite brittle when stressed by the volume expansion of dispersed phases on corrosion. Because of cracking, corrosion of the disposed phases remote from the surface becomes possible. (J.E.D.)

220

THE CREEP OF SINGLE CRYSTALS OF ZINC IN READILY FUSIBLE METALLIC MELTS. V. A. Labzin and V. I. Likhtman (Saratov Pedagogical Inst.). Doklady Akad. Nauk S.S.S.R. 121, 443-5(1958) July 21. (In Russian)

Effects of surface-active layers of tin, lead, or their alloys on the creep of zinc monocrystals were studied from room temperature to 400°C. The results agreed with previously published data on the increased rate of metallic monocrystal creep in surface-active media. (R.V.J.)

221

AN INVESTIGATION OF THE STRUCTURE OF LIQUID Bi–Sn ALLOYS. N. V. Alexeev and Ya. I. Gerasimov (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 121, 488-91(1958) July 21. (In Russian)

Studies were made of the structure and the qualitative relation of the structure and the properties of liquid alloys of 20% Bi – 80% Sn, 40% Bi – 60% Sn, 60% Bi – 40% Sn, and 80% Bi – 20% Sn. (R.V.J.)

222

ON THE DESTABILIZATION OF THE CUBIC FORM OF ZIRCONIUM DIOXIDE. O. M. Margulis and N. V. Gul'ko (All-Union Scientific-Research Inst. of Refractory Materials). Doklady Akad. Nauk S.S.S.R. 121, 523-6(1958) July 21. (In Russian)

Specimens of zirconium dioxide were stabilized with 10 to 30 mole % CaO and 14 to 35 mole % MgO. The stabilization was made in the arc furnace and by a ceramic sintering of fine powdered mixtures at 1750°C for 6 hr. Petrographic and x-ray investigations showed that both melted and sintered zirconium dioxide have cubic structures. Phase constitutions of stabilized specimens of ZrO_2 after sintering for 50 hr at 1200°C are tabulated. Data indicate that the decomposition rate of hard solutions of $CaO-ZrO_2$ and $MgO-ZrO_2$ depends on the content of the admixture and the concentration of solid solution. The solid solutions in the $CaO-ZrO_2$ system have higher stability than the $MgO-ZrO_2$ system. The studies indicate the complex mechanism of solid solution decomposition and the importance of further investigations. (R.V.J.)

223

ON THE ROLE OF EXTERNAL STRESS IN RECOVERY FROM PLASTIC DEFORMATION. M. B. Makogon, V. E. Panin, et al (Kuilyshev Tomsk State Univ.). Doklady Akad. Nauk S.S.S.R. 122, 219-21(1958) Sept. 11. (In Russian)

An attempt was made to determine experimentally the stimulating effect of external stress on the recovery from deformation of copper and copper alloyed with Al and Ni (5, 10, and 15 at. %) and Zn (5 at. %). The effects of material and deformation conditions (rate, temperature, etc.) were noted. (R.V.J.)

224

A NEW LAW OF CREEP RUPTURE. I. A. Oding and V. N. Geminov. Doklady Akad. Nauk S.S.S.R. 122, 222-5(1958) Sept. 11. (In Russian)

An exponential law is developed for creep rupture and compared with the experimental curves for various types of steel. (R.V.J.)

225

BEHAVIOR OF MATERIALS AT VERY HIGH TEMPERATURES. Irving J. Gruntfest and Lawrence H. Shenker (General Electric Co.). Ind. Eng. Chem. 50, No. 10, 75A-6A(1958) Oct.

The over-all complex process of thermal deterioration of materials at high temperatures is resolved into simpler and more independent phenomena, including heat absorbing capacity, gas rate generation, liquefaction and vaporization, spalling, and oxidation. Materials are considered from these standpoints in choosing the best material for a specific application. (J.R.D.)

226

USING THE HALF-VALUE LAYER TO SOLVE RADIOGRAPHIC PROBLEMS. A. E. Oaks (Westinghouse Electric Corp., Pittsburgh). J. Soc. Non-Destructive Testing 16, 381-4(1958) Sept.-Oct.

The application of half-value layer data to the rapid preparation of exposure curves, the transfer of exposure conditions from one x-ray machine to another, the effect of filters on contrast, determination of the optimum beam voltage, and the determination of the equivalent monochromatic x-ray beam voltage are discussed. (J.R.D.)

227

RADIOGRAPHY AND AUTORADIOGRAPHY OF PLUTONIUM. Dana E. Elliott and Gerold H. Tenney (Los Alamos Scientific Lab., N. Mex.). J. Soc. Non-Destructive Testing 16, 430-7(1958) Sept.-Oct.

A method of inspecting the internal condition of plutonium is described. By familiarization of the type of radiation originating in this metal, radiographers can undertake preventive measures to avoid its damaging influence on the radiographic image. (J.R.D.)

228

TETRAHEDRAL CO-ORDINATION IN Ni(II). Leonard I. Katzin (Argonne National Lab., Lemont, Ill.). Nature 182, 1013-14(1958) Oct. 11.

Results of studies on the absorption spectra of nickel compounds in tributyl phosphate and in acetone media led to the conclusion that paramagnetic nickelous compounds which are the normal green color, or the spectra of which show the equivalent of the 410-mμ absorption peak of the green form, are to be presumed to be 6-co-ordinate, or at least to possess the electronic structure characteristics of the 6-co-ordinate state. Paramagnetic compounds of Ni(II) which fail to show this absorption peak (and which may be blue, if the color is not masked by the ligand) are presumably tetrahedral, or have the equivalent electronic structure. Diamagnetic compounds have the square planar form. (C.H.)

229

BRAZING BY REMOTE CONTROL. INDUCTION HEATING FINDS APPLICATIONS IN ATOMIC ENERGY. Nuclear Power 3, 503(1958) Oct.

The applications of brazing by remote control using induction heating are described. The work of Delapena and Son in developing the technique is reviewed. (W.D.M.)

230

DISCRETE FIXED POISON RODS CONTAINING BORON. W. E. Ray, W. A. Neisz, and H. W. Cooper (Knolls Atomic Power Lab., Schenectady, N. Y. and Superior Tube Co., Norristown, Penna.). Nuclear Sci. and Eng. 4, 386-401(1958) Sept.

Boron alloys with titanium and zirconium were examined as core materials for fixed poison components in the S3G reactor core without success. Subsequent work has demonstrated that round rods of 18% chromium, 15% nickel, 0.2% boron-10 stainless steel contained in an unbonded low cobalt stainless cladding will serve successfully in this application. Data on the irradiation and corrosion performance, mechanical properties, and thermal cycling resistance of the poison rods are presented. The elements are prepared by forging, rolling, and drawing the core alloy to final size, then cold drawing a tube of the cladding alloy onto its surface. Details of this fabrication procedure and methods for evaluating the end product are presented. (auth)

231

BORON CONTAINING CONTROL MATERIALS. D. N. Dunning, W. K. Anderson, and P. R. Mertens (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 4, 402-14(1958) Sept.

The study of boron stainless steel, Zircaloy-boron, and titanium boron alloys for use in reactors is discussed. Fabrication techniques, physical and mechanical properties, corrosion data in high-temperature water, and radiation damage resistance data are included. (auth)

232

BORON STAINLESS STEEL ALLOYS. L. B. Prus, E. S. Byron, and J. F. Thompson (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 4, 415-28(1958) Sept.

Several boron-stainless steels containing from approximately 0.2 to 3.0 wt.% boron were investigated for possible use as a reactor control material. Fabrication methods, physical properties, wear and corrosion resistance of the alloys were examined. (auth)

233

NEW DEVELOPMENTS IN THE FABRICATION OF HAFNIUM CONTROL RODS. J. Giacobbe and D. N. Dunning (Superior Tube Co., Phoenixville, Penna. and Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 4, 467-80(1958) Sept.

Symmetric Y-bladed shapes were fabricated of hafnium material for use as reactor control rods. Material fabrication techniques are discussed. The fabrication of strip hafnium and strip Zircaloy by welding into suitable shapes applicable for reactor control is outlined. Photographs of fabrication techniques, test components, and equipment used are included. (auth)

234

A METHOD OF HOT COEXTRUDING COMPLEX SHAPES THROUGH ROUND DIES. W. E. Ray and C. J. Beck (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 4, 481-94(1958) Sept.

A round die hot coextrusion technique used to prepare rods having complex cross sections was developed and successfully applied to the fabrication of powder metallurgy parts with and without external cladding. The procedure involves assembling and extruding steel billets of round cross section which contain an axially located assembly of powder metallurgy and sheet metal parts which is an enlarged and shortened mockup of the desired part. After extrusion, the steel parts are removed and a fully dense rod having the desired shape and composition remains Rods having several compositions in metallurgically joined zones along their lengths can be produced by this method. For example, a Y-shaped rod with a Ti-25 vol. % Eu_2O_3 dispersion at one end, a Ti-10.7 vol. % B^{10} dispersion midsection, and a pure Ti length at the other end was successfully produced. It showed dimensional uniformity in keeping with usual tolerances for reactor control components and was clad with a fully bonded, 0.005-inch thick layer of titanium. Data on the physical properties, corrosion performance, thermal cycling resistance, and irradiation damage resistance of parts produced by this technique are presented. These data indicate that the method can be successfully used to produce reactor components which are very difficult to manufacture by other techniques. (auth)

235

PHENOMENOLOGICAL ANALYSIS OF THE DECAY PROCESSES OF THE Σ-AND Λ-HYPERONS. Yoshio Yamaguchi (CERN, Geneva). Progr. Theoret. Phys. (Kyoto) 19, 485-94(1958) May.

On the basis of the so-called $\Delta I = \frac{1}{2}$ law, the decay processes of Σ- and Λ-hyperons are discussed. In particular, the asymmetry coefficients of the pion coming from hyperon decay are expressed in terms of ratios of partial decay rates of Σ^+-and Σ^--hyperons, and these are useful to test the original assumption of the $\Delta I = \frac{1}{2}$ law. The connection between the Σ- and Λ-decay interactions is also mentioned briefly. (auth)

236

THE WARM PRESSING (800°C.) OF UO_2 AND UO_2-METAL MIXTURES. R. Scott and J. Williams (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. Brit. Ceram. Soc. 57, 199-209(1958) Apr.

Fine non-stoicheiometric UO_2 powders can be compacted to at least 90% theoretical density at 800°C under 10 t/in^2 pressure. The addition of powders of iron, tungsten, tantalum, uranium, and magnesium inhibits densification. The effect is considered to be due to the removal of oxygen in excess of the stoicheiometric amount from the UO_2. Possible mechanisms of densification are discussed. (auth)

237

THE KINETICS OF THE LITHIUM-COPPER SYSTEM. Wilhelm Klemm and Bogdan Volavšek. Z. anorg. u allgem. Chem. 296, 184-7(1958). (In German)

Lithium forms yellow mixed crystals with copper of the substitution type. The composition range of the crystals is almost $LiCu_4$. The volume increase of the lithium in these mixed crystals is about 8 cm^3 and is therefore smaller than the atomic volume of lithium metal (13.0 cm^3). This volume change agrees with those observed in intermetallic phases containing electropositive and noble metals. (tr-auth)

238

A STUDY OF THE THERMODYNAMIC PROPERTIES OF BINARY IRON-MANGANESE SYSTEM IN THE SOLID STATE. A. P. Lyubimov, A. A. Granovskaya, and L. E. Berenshtein (Stalin Moscow Inst. of Steel). Zhur. Fiz. Khim. 32, 1591-6(1958). (In Russian)

Descriptions are given of the method for determining the partial vapor pressure of binary system components by open surface evaporation with subsequent analysis of the vapor phase. On transforming the Gibbs-Duhem equation and graphically integrating, the partial pressure could be determined without determination of the absolute quantity of each component and of the evaporating surface. Studies were made of the iron-manganese system in the solid state at 1213, 1363, and 1447°K, the molar concentration of manganese varying from 0.0004 to 0.506. The metal ratio in the vapor was determined by a spectral analysis. The partial vapor pressure and activity coefficient values show this system to approach an ideal solution. (tr-auth)

239

THE ELECTROMOTIVE FORCES AND ELECTRODE POTENTIALS OF TIN AND IRON IN SYSTEMS WITH TIN CONTAINING FLUX ELECTROLYTES. A. L. Vitkin (Central Inst. of Ferrous Metallurgy, Moscow). Zhur. Fiz. Khim. 32, 1612-17(1958). (In Russian)

Measurements show that in the galvanic cell tin/flux/Fe, tin is the anode, whereas iron (plate) is the cathode on which tin from the electrolyte is deposited. Hence on close circuiting the cell the electrode potential difference is at its maximum value only for a fraction of a second, after which, owing to the shift of the cathodic potential to the negative, the emf falls. At high temperature the flux diffusion processes during the precipitation of the tin on the cathode are quite rapid, forming the intermetallic compounds $FeSn_2$ of a new crystal structure. Measurements of emf and electrode potentials of tin and iron in systems with tin containing electrolytes were carried out with respect to duration of the process and concentration of the tin chlorides. It was shown that in molten fluxes the process of tin deposition on the cathode is more rapid than when the flux is in the form of a solution. Measurements of the emf of the system $Zn/ZnCl_2/Fe$ characterize the work of the flux during thermal zinc plating. In this case the emf is considerably higher than in Sn—Fe galvanic pairs. (tr-auth).

240

ELECTRON DIFFRACTION AND OPTIC DATA ON THE THICKNESS OF OXIDE FILMS ON METALS. V. V. Andreeva and N. A. Shishakov (Inst. of Physical Chemistry, Moscow). Zhur. Fiz. Khim. 32, 1671-2(1958). (In Russian)

Measurements were made of the oxide film thickness of Al, Au, Fe, Pt, and Ti in vacuum (10^{-7} mm mercury column) at atmospheric pressure with the relative humidity 40 to 45% and at room temperature. (R.V.J.)

241

METALS. Presented at the Second Pacific Area National Meeting, Los Angeles, Calif., September 17-21, 1956. ASTM Special Technical Publication No. 196. Philadelphia, American Society for Testing Materials, 1957. 181p. $4.50.

Papers are presented on: Studies of Type 301 Stainless Steel Columns; Shotpeening Effects and Specifications; The Effect of Forming on Mechanical Properties; Axial Stress Fatigue, Creep, and Rupture Properties of Unnotched and Notched Specimens of Heat Resistant Alloys; Determination of Young's Modulus Under Conditions of Relaxation; Effect of a Number of Variables on the Fatigue Properties of High Strength Steels; The Effect of Temperature, Frequency, and Grain Size on the Fatigue Properties of High Purity Aluminum; Determination of Fatigue-Crack Initiation and Propagation in a Magnesium Alloy; Uni-directional Axial Tension-Fatigue Tests of Beryllium Copper and Several Precipitation Hardening Corrosion Resistant Steels; The Properties of Beryllium Copper Strip as Affected by Cold Rolling and Heat Treatment; and Pit Depth Measurements as a Means of Evaluating the Corrosion Resistance of Aluminum in Sea Water. (T.R.H.)

242

SYMPOSIUM ON TITANIUM. Presented at the Second Pacific Area National Meeting, Los Angeles, Calif., September 17 and 18, 1956. ASTM Special Technical Publication No. 204. Philadelphia, American Society for Testing Materials, 1957. 214p. $4.75.

The effects of variations in stress, strain, time, and temperature during thermal exposure on the tendency toward thermal instability in Ti-Mo-Cr-Fe, Ti-Al-V, and Ti-Al-Mn alloys were investigated. The limits of uniform elongation were measured for typical alpha, alpha-beta, and beta titanium alloys. The effect of composition and annealing treatment on the thermal stability of Cr—Mo alloys of Ti is presented. The testing procedures and equipment used to obtain elevated-temperature tensile, creep, stress-rupture, and stress-stability properties of the Al—V—Ti alloy are presented. Tension, creep-rupture, and stability test results for Ti-base alloys are discussed. The effects of carbon and nitrogen contamination on the notch tensile properties of Ti are reported. A micro-impact test is described for Ti alloys. The measurement of elastic modulus of Ti alloys is presented. The corrosion and ignition of Ti in fuming HNO_3 are discussed. The properties and fabrication characteristics of wrought Ti products are presented. The development of standardized specimen preparation and testing techniques for unalloyed Ti sheet is presented. The general problem of the determination of the gaseous elements, oxygen, hydrogen, and nitrogen in titanium is reviewed. (W.L.H.)

243

PHYSICAL METALLURGY OF URANIUM. A. N. Holden. Reading, Mass., Addison-Wesley Publishing Company, Inc., 1958. 271p. $5.75.

The history, occurrence, and preparation of uranium metal are discussed. The radioactivity and nuclear reactions of uranium are discussed at length. Melting point and allotropy of uranium are given, along with the structure of alpha, beta, and gamma uranium. The physical and chemical properties of the metal are described at length. Elastic, anelastic, hardness, tensile, creep, notched-bar impact, and fatigue properties for uranium metal are given. The deformation of uranium is discussed. Recovery, recrystallization, and grain growth are given. Transformation kinetics in uranium and uranium alloys is presented. Growth of uranium single crystals is described. Diffusion in binary uranium alloys, rare-gas diffusion in uranium, and self-diffusion in uranium are presented. Radiation damage and thermal-cycling growth of uranium are discussed. Design of metallic fuel elements and metallography of uranium are presented. (W.L.H.)

244

THORIUM PRODUCTION TECHNOLOGY. F. L. Cuthbert. Reading, Mass., Addison-Wesley Publishing Company, Inc., 1958. 312p. $6.50.

The first and second chapters contain background information on uses and physical and chemical properties of thorium metal and compounds. The third chapter is concerned with thorium-bearing ores and their concentration. Succeeding chapters describe the various steps for extracting and purifying the ore and reducing it to the metal and methods for casting and fabricating the metal. Other chapters are concerned with the health and safety aspects of thorium production and with the chemical and physical methods of testing thorium. (W.L.H.)

PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

245 CERN-58-6 a

European Organization for Nuclear Research, Geneva. LE SYNCHROTRON A PROTONS DU CERN (lere Partie). (The CERN Proton Synchrotron. Part I.). E. Regenstreif. July 1958. 243p.

Elementary theory of alternating-gradient synchrotrons is discussed in sections on: principles of conventional proton synchrotrons (constant gradient); principle of the alternating gradient synchrotron; betatron oscillations in an alternating gradient synchrotron; synchrotron oscillations; and the idea of acceptance (beam half-thickness times angular half-opening). The project and the considerations made in the choice of specifications are described and outlined. The electromagnet and radioelectric acceleration equipment are described in detail. (T.R.H.)

246 CERN-58-20

European Organization for Nuclear Research, Geneva. FAST GATE. A. V. Tollestrup and J. B. Lindsay. Aug. 27, 1958. 9p.

This gate circuit is arranged to accept fast pulses within the gate pulse which is 50 mμ sec long and to lengthen this pulse to 0.3 μ sec suitable for amplification with the Hamner Non-Overload Amplifier, and by using the Liverpool 500 mμ sec gate and lengthener the result may be displayed on the 100 channel Hutchinson Scarrot Pulse-Height Analyzer. It is intended to be used for obtaining pulse-height information from a counter which is counting at a very high rate, but in which only a small fraction of pulses correspond to events which are desired. The circuit is basically a diode gate followed by a four terminal pulse-shaping network. (W.L.H.)

247 UCRL-8296
California. Univ., Berkeley. Radiation Lab.
ANALOG TRACKING OF THE BEVATRON BEAM DURING ACCELERATION AND DECELERATION. Harry G. Heard. July 3, 1958. 14p. Contract W-7405-eng-48. $0.50(OTS).

The development of function generators designed to synthesize a correction function in the open-loop radiofrequency accelerating equipment of the Bevatron is outlined. A function generator is described that will control the beam position during acceleration and deceleration. The mechanisms of phase transition and beam deceleration are delineated. Results of beam deceleration from 6.25 Bev to 300 Mev are given. Advantages of beam deceleration and analog frequency tracking are discussed. (auth)

248 AEC-tr-3407
A SYNCHROPHASOTRON IS PUT INTO OPERATION IN USSR. Translated from Krasnaya Zvezda No. 87, p.3 and No. 88, p.4 (1957). 4p.

Some details and equipment specifications are given for the 8.3 Bev proton synchrotron for the Joint Nuclear Research Institute in Dubna. (W.D.M.)

249
MULTIPLE INJECTION OF ELECTRONS INTO THE BETATRON CYCLE. V. P. Yashukov (Leningrad Inst. of Physics and Technology). Zhur. Tekh. Fiz. 28, 1363-4(1958) June. (In Russian)

Analysis was made of the intensities in electron two-pulse injection, 22 and 30 kev and 1.5 μsec duration, into the acceleration chamber during one cycle of acceleration. (R.V.J.)

PHYSICS AND MATHEMATICS

General

250 AD-144784
Rocketdyne Div., North American Aviation, Inc., Canoga Park, Calif.
PROJECT SNOOPER: A PROGRAM FOR RECONNAISSANCE OF THE SOLAR SYSTEM WITH ION PROPELLED VEHICLES. M. I. Willinski and E. C. Orr. June 19, 1956. 48p.

A program for the unmanned reconnaissance of the Solar System using a light-weight nuclear-powered ion rocket lifted into an Earth satellite orbit by a chemical propellant rocket, is described. A weight statement for the components of the interplanetary vehicle together with an analysis of the problem areas which will be encountered is presented. Drawings of the proposed vehicle together with a mathematical analysis of a method for trajectory calculations are included. (auth)

251 AERE-C/R-1463
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE INTENSITY OF β ACTIVITY FROM THICK SOURCES. PART II. B. J. Bowles and G. N. Walton. June 21, 1954. 8p.

Further measurements of the effect of source thickness on the counting rate recorded by β counters for spread sources are reported. As predicted by theory, the ratio between a very thick source and a very thin source for an end window counter is double that for the same sources in a 2 π counter. Changes in wall scattering are more important than changes in source position, on the source thickness effect for an end window counter. (auth)

252 CAL-HF-845-D-19
Cornell Aeronautical Lab., Inc., Buffalo.
DESIGN MANUAL OF METHODS OF FORCED AIR COOLING ELECTRONIC EQUIPMENT. June 1958. 238p. Contract NObsr-63043.

This Manual was prepared under the sponsorship of the Department of the Navy, Bureau of Ships, to aid electronic engineers in the thermal design of reliable electronic equipment. Principles and techniques to be followed in the design of electronic parts, assemblies, and equipments are outlined herein to permit heat transfer by forced convection to be reliably achieved. (auth)

253 HW-53231
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE SPACE-FILLING CHARACTERISTICS OF 4, 7, 13 AND 19 ROD CLUSTER FUEL ELEMENTS. T. W. Evans. Oct. 14, 1957. 47p. Contract [W-31-109-Eng-52]. $7.80(ph OTS); $3.30(mf OTS).

Calculations of the space-filling characteristics of 4, 7, 13, and 19 rod cluster fuel elements were carried out and the results are presented graphically. The following cases or ranges of parameters were included: cladding thickness 0.005, 0.020, 0.030, and 0.040 in., process tube radius 0.4 to 2.4 in., and rod-to-rod separation 0.040 to 0.180 in. (W.D.M.)

254 HW-57399
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
SURFACE DOSE RATE MEASUREMENTS. J. F. Evans. Sept. 9, 1958. 22p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

A procedure is presented for estimating the surface dose rates of gamma and high-energy beta sources. Conversion factors applicable to the Cutie Pie dose rate meter are derived. (W.D.M.)

255 KAPL-M-MSP-2
Knolls Atomic Power Lab., Schenectady, N. Y.
THE S.F.O. CODE. H. E. Stevens and M. S. Pendergast July 2, 1958. 14p. Contract W-31-109-Eng-52. $3.30 (ph OTS); $2.40(mf OTS).

Simultaneous first-order differential equations and a comparison code to solve these equations numerically are described in terms of the radioactive accessibility problem. (J.R.D.)

256 KAPL-M-OAC-2
Knolls Atomic Power Lab., Schenectady, N. Y.
INPUT PREPARATION FOR REM, A TWO-DIMENSIONAL DIFFUSION THEORY CODE FOR THE IBM 704. O. A. Clendinning and M. A. Ketchum. Aug. 15, 1958.

24p. Contract W-31-109-Eng-52. \$3.30(ph OTS); \$2.40(mf OTS).

REM, a modified version of CURE, was written to permit diagonal interfaces and boundaries. A description of the input and output formate is presented. (auth)

257 NP-6967
Ramo-Wooldridge Corp. Space Technology Labs., Los Angeles.
COMPARATIVE PERFORMANCE OF BALLISTIC AND LOW-THRUST VEHICLES FOR FLIGHT TO MARS. J. H. Irving and E. K. Blum. 1958. 16p.

A ballistic and a low-thrust (ion propulsion) rocket are compared as to payload for a round-trip flight to Mars. (T.R.H.)

258 NP-6976
MSA Research Corp., Callery, Penna.
PARTIAL FILM BOILING WITH WATER AT 2000 PSIG IN A ROUND VERTICAL TUBE. Technical Report No. 62. J. B. McDonough, W. Milich, and E. C. King. Oct. 8, 1958. 48p. Contract NObs-65426.

A study of the partial film boiling region of water at 2000 psig was made in a $\frac{1}{4}$ in. OD vertical Inconel-X tube, 0.152 in. ID × $12\frac{1}{2}$ in. long. The water parameters were: mass flow rates approximately 0.4×10^6 to 1.5×10^6 lb/hr-sq ft, at inlet enthalpies of ~377 to 614 Btu/lb. NaK, a liquid metal, was used as the heating medium. The wall temperatures measured in the nucleate boiling region agreed within approximately ±10°F of Jens & Lottes correlation. The burnout heat flux results reported agree within approximately ±25% of WAPD (Bettis Plant) correlation. The film boiling data do not appear to yield to correlation over the range investigated in this experiment. The partial film boiling coefficients found in this experiment range from approximately 100 to 10,000 Btu/hr sq ft-°F. (auth)

259 NP-6978
Convair Scientific Research Lab., San Diego, Calif.
A METHOD FOR INVESTIGATION OF THE PROPERTIES OF SOLUTIONS OF THE EQUATION $\ddot{x} + f(x,t)\dot{x} + g(x,t) = \phi(t)$ (thesis). Research Report No. 4. Eugene J. Putzer. July 31, 1958. 137p.

Submitted to the Univ. of Minnesota.

A brief discussion of the general technique as it would be applied to a system of differential equations is given, together with some remarks as to how the technique can be used to investigate existence, uniqueness, boundedness, and stability of solutions. (auth)

260 SCTM-253-58(14)
Sandia Corp., Albuquerque, N. Mex.
FOLDED WIRE STRUCTURES AS RECEIVING ANTENNAS. C. W. Harrison, Jr. June 18, 1958. 30p. Contract AT(29-1)-789. \$4.80(ph OTS); \$2.70(mf OTS).

It is shown that the receiving qualities of a conventional folded dipole may be predicted easily in terms of the receiving characteristics of an appropriately dimensioned solid wire antenna. The theory advanced is sufficiently general to permit the analysis of practically any symmetrically loaded folded wire configuration suitable for reception. (auth)

261 SCTM-323-58(16)
Sandia Corp., Albuquerque, N. Mex.
HIGH-ALTITUDE PSYCHROMETRIC TABLES. L. D. Oppliger. Sept. 5, 1958. 19p. Contract AT(29-1)-789. \$0.75(OTS).

The purpose of this study was to obtain psychrometric curves at a pressure of 12 psi. This is the atmospheric pressure at Albuquerque, New Mexico. The curves needed were plots of relative humidity as a function of wet-bulb depression at a constant dry-bulb temperature. These curves were available for dry-bulb temperatures up to 140°F. However, curves for dry-bulb temperatures from 140° to 200°F were missing. Curves for these high dry-bulb temperatures were obtained theoretically. Three of these curves (160°, 180°, and 200°F) were verified experimentally by capturing a sample of air, and measuring wet-bulb and dry-bulb temperatures, and the relative humidity. The relative humidity was determined using the dew point method. The experimental and theoretical points agree within experimental error, so the method used to calculate the curves was verified. A complete chart for dry-bulb temperatures from 30° to 200°F is included in the paper. (auth)

262 UCRL-5116(Pts.I and II)
California. Univ., Livermore. Radiation Lab.
GASEOUS THERMAL DIFFUSION. PART I. BIBLIOGRAPHY OF OPEN LITERATURE, 1940-57. Cecilia McFadden, comp. PART II. A BIBLIOGRAPHY OF THE REPORT LITERATURE, 1941-1957. Frederick E. Frost, comp. Jan. 1958. (Pt. I, 29p. and Pt. II, 7p.) Contract W-7405-eng-48. Pt. I, \$4.80(ph OTS); \$2.70 (mf OTS); Pt. II, \$1.80(ph OTS); \$1.80(mf OTS).

These two parts were issued separately, but are cataloged as a unit.

This bibliography includes references on separation of gases by thermal diffusion, thermal diffusion column technique, theory of separating gases by thermal diffusion, and design of thermal diffusion equipment. (W.L.H.)

263 UCRL-5246
California. Univ., Livermore. Radiation Lab.
ON THE PROBLEM OF "BEST APPROXIMATION." Arnold N. Lowan. June 1958. 18p. Contract W-7405-eng-48. \$0.50(OTS).

The de la Vallee Poussin's treatment of the problem of obtaining the "best solution" of a system of n equations with fewer than n unknowns and its application to the problem of curve fitting is described. A modification of the method suitable for the treatment of large systems and based on an extension of the gradient method for minimizing a function of two or three variables is also briefly discussed. (auth)

264 UCRL-5248
California. Univ., Livermore. Radiation Lab.
ON THE BLISS ALGORITHM AND ITS APPLICATION TO THE TREATMENT OF MANY-POINT BOUNDARY PROBLEMS. Arnold N. Lowan. June 1958. 15p. Contract [W-7405-eng-48]. \$0.50(OTS).

The Bliss algorithm, originally discovered in connection with the theory of differential variations in exterior ballistics, is applied to the treatment of many-point boundary problems for linear differential equations and systems of linear differential equations of the second and higher order. (auth)

265 UCRL-5249
California. Univ., Livermore. Radiation Lab.
ON THE KANTOROVICH TREATMENT OF BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS. Arnold N. Lowan. June 5, 1958. 14p. Contract W-7405-eng-48. \$0.50(OTS).

A solution of the Poisson differential equation $\Delta u - p(x, y) = 0$ for a region bounded by $x = a$ and $x = b$ and the curves $y = g(x)$ and $y = h(x)$ may be derived by solving the equivalent problem of minimizing the integral $\iint \{(\partial u/\partial x)^2 + (\partial u/\partial y)^2 + 2pu\}\,dxdy$ by means of a function $u = \phi(x, y)v(x)$, where $\phi(x, y)$ is a known function vanishing on the curved boundaries and $v(x)$ is a function to be determined and vanishing at $x = a$ and $x = b$. This leads to an ordinary differential equation for the function v(x). (auth)

266 UCRL-5250
California. Univ., Livermore. Radiation Lab.
ON THE USE OF CHEBYSHEV POLYNOMIALS IN NUMERICAL ANALYSIS. Arnold N. Lowan. June 5, 1958. 21p. Contract W-7405-eng-48. $0.75(OTS).

The use of Chebyshev polynomials in the problem of interpolation and curve fitting and in the very important problem of obtaining economized expansions of differential equations, either in the form of polynomials in x or in the form of polynomials in 1/x is examined. (auth)

267 UCRL-8415
California. Univ., Berkeley. Radiation Lab.
TABLES OF SPHERICAL BESSEL FUNCTIONS FOR COMPLEX ARGUMENT. Kenneth R. Greider. Aug. 12, 1958. 22p. Contract W-7405-eng-48. $0.75(OTS).

The spherical Bessel functions for complex argument arise in many physics and engineering problems that involve the scattering of waves from absorbing media of spherical or cylindrical symmetry. Only tables of the functions of low order are presented here, and the zero-order function, $j_0(z) = \sin(z)/z$, is not given because it can be easily obtained from available compilations of the sin function for complex argument. (auth)

268 AEC-tr-3422
STUDY OF COMBUSTION IN GAS PRESSURE-REDUCTION VALVES. A. E. Leduc. Translated by K. S. Bevis (Savannah River Lab.) from Z. Schweisstech. 45, 239-45(1955). 12p.

A search for a plastic material to replace ebonite for the valve assembly used on oxygen storage cylinders was conducted. The field was narrowed to nylon and teflon. In addition to oxygen tests, these materials were exposed to acetone and acetylene. Various physical tests were also performed. A discussion of procedures and results is presented. (J.R.D.)

269 NP-tr-170
ON THE THEORY OF KINETIC PHENOMENA IN SEMICONDUCTORS WITH A NARROW IMPURITY BAND. V. M. Nitsovich. Translated for Lincoln Lab., MIT from Zhur. Tekh. Fiz. 28, 1201-6(1958). 9p.

The influence of the correlation between electrons on the kinetics of processes in a narrow impurity band taking into account the influence of the compensating impurities was investigated. Previous results were used to derive the electrical conductivity, the Hall effect constant, and the thermal emf formulas in semiconductors with a narrow impurity band. (J.R.D.)

270
SOLAR FLARES, CONCURRENT COSMIC RAY BURSTS AND SUBSEQUENT GEOMAGNETIC STORMS. S. L. Malurkar (Colaba Observatory, Bombay). Acta Phys. Acad. Sci. Hung. 8, 285-300(1958).

Five large cosmic-ray bursts in connection with solar flares have been observed up till now. Two of them were followed by geomagnetic storms associated with cosmic ray disturbances when both the phenomena could be closely correlated. Two of the biggest geomagnetic storms recorded at Alibag have also been considered. Just as in geomagnetism, it was thought that a study should be made not merely of individual flares but also of the evolution and progress of solar active regions for the above phenomena. Big cosmic ray bursts along with solar flares occurred when the active regions on the sun had a long previous history of more than usual activity either when the active region was near the C. M. or near the western limb of the sun. In the former case, a geomagnetic storm followed which could be closely correlated with a simultaneous cosmic ray disturbance. In the latter, no such type of geomagnetic disturbance followed. In the case of the two biggest geomagnetic storms, the active region was more ephemeral in age or history. The large flares occurred at the period of dissolution of the region soon after its C. M. passage. The particles responsible for the very big solar flares have atomic numbers neither too low nor too large in the periodic table and are positively charged. The frequency of such events being small the elements involved must be from those in the sun whose abundance is relatively scarce. Detailed spectroscopic examination would decide what these elements are (Sr, Ba, etc.).

271
RAMAN AND INFRARED SPECTRA OF MOLECULES OF DEUTEROETHANES. R. van Riet (Univ. of Louvain, Belgium). Ann. soc. sci. Bruxelles 71, No. 2, 102-27 (1957). (In French)

The assignments which were suggested for the fundamental vibrations of molecules of deuteroethanes were reviewed and verified. Very precise measurements were made of the Raman gas rays by using a tube with multiple reflections. The recent theoretical progress on the subject of the sum rule permitted the usage of certain criteria for the verification of assignments to which were joined the isotopic product rule. (tr-auth)

272
PURE ROTATION SPECTRA OF LIGHT AND HEAVY VINYL BROMIDES BY THE METHOD OF MICROWAVES. P. Goedertier and K. L. Lee (Univ. of Louvain, Belgium). Ann. Soc. sci. Bruxelles 71, No. 2, 128-33(1957). (In French)

The measurements made by Cornwell (J. Chem. Phys. 18, 1118(1950)) on the pure rotation spectra of light vinyl bromide were repeated and extended to the deutero-substituted bromides. The series of absorption rays, observed in the region from 18,000 to 25,000 Mc/sec, is tabulated for $CH_2 = CHBr^{81}$ and $CH_2 = CHBr^{79}$, $CH_2 = CDBr^{79}$ and $CH_2 = CDBr^{81}$, $CD_2 = CHBr^{79}$ and $CD_2 = CHBr^{81}$, and $CD_2 = CDBr^{79}$ and $CD_2 = CDBr^{81}$. A description is given of the spectrograph used. (J.S.R.)

273
PURE ROTATION SPECTRA OF VINYL BROMIDES. P. Goedertier and K. L. Lee (Univ. of Louvain, Belgium). Ann. soc. sci. Bruxelles 71, No. 3, 184-8(1957). (In French)

The pure rotation frequencies corresponding to the transitions 2 → 3 are given for $CH_2 = CHBr$, $CH_2 = CDBr$, $CD_2 = CHBr$, and $CD_2 = CDBr$ with a greater precision than were given previously. The variations between the values observed and those calculated beginning with commonly accepted dimensions are discussed. (tr-auth)

274
ELECTRONIC PROCESSES IN THE LUMINESCENCE OF IONIC CRYSTALS. A. Meessen (Univ. of Louvain, Belgium). Ann. soc. sci. Bruxelles 71, No. 3, 222-46 (1957). (In French)

The energy states of electrons in the perfect crystal, in the pure crystal colored by its defects, and in the crystal "activated" by the introduction of foreign ions are discussed. The internal processes of luminescence are treated generally. The experimental methods and the formulas which permit the definition of the structure of the centers in question are described. The quenching of the luminescence by a temperature effect and by a concentration effect is studied in detail. (J.S.R.)

275

SPECTRAL DISTRIBUTIONS OF 280 kVp X RAYS. D. V. Cormack, W. E. Davitt, D. G. Burke, and E. G. Rawson (Univ. of Saskatchewan and Saskatoon Cancer Clinic, Canada). Brit. J. Radiol. 31, 565-70(1958) Oct.

Spectral distributions of both primary and scattered 280 kVp x rays have been measured with a scintillation spectrometer and are presented in tabular form. The attenuation of the primary beam was calculated from the primary spectra and found to be in good agreement with measured attenuation data. Scattered radiation spectra were measured at depths of 2, 5 and 15 cm below the surface of a water phantom using field sizes of 50 cm^2 and 300 cm^2. Variation in depth and field is found to produce rather small changes in the shape of the scattered spectra. Primary and scattered radiation spectra were normalized and added together to obtain the spectral distribution of the combined radiation. These combined spectra were used to calculate the relative energy absorption in bone and muscle at the various depths. (auth)

276

THE FINE STRUCTURE OF THE X-RAY ABSORPTION K-SPECTRA OF TITANIUM IN TITANATES. E. E. Vainstein, M. N. Bril, and I. B. Staryi (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 122, 201-3(1958) Sept. 11. (In Russian)

The fine structure of x-ray absorption K spectra of titanium in Ba, Ca, Fe, Mo and Zr titanates was investigated. The titanium absorption spectra in titanates is characterized by clear and abundant fluctuations which vary with the type of crystal structure, properties of chemical bonds, and polarization state of titanium and oxygen atoms. (R.V.J.)

277

ALLOWANCE FOR PSEUDOTRIDENT PROCESSES IN ESTIMATING THE CROSS-SECTION FOR THE DIRECT FORMATION OF ELECTRON-POSITRON PAIRS BY ELECTRONS. V. A. Tumanyan, V. A. Zharkov, and G. S. Stolyarova. Doklady Akad. Nauk S.S.S.R. 122, 208-10(1958) Sept. 11. (In Russian)

The number of pseudotrident processes was calculated by Monte Carlo methods using nuclear emulsion data. The radiation unit of length was taken as equal to 2.94 cm. (R.V.J.)

278

LIGHT CONDITIONS INSIDE A DISPERSING MEDIUM AND THE SPECTROSCOPY OF DISPERSED SUBSTANCES. G. V. Rosenberg. Doklady Akad. Nauk S.S.S.R. 122, 211-14(1958) Sept. 11. (In Russian)

The theoretical basis and corrections for certain regularities in the light conditions inside dispersed media were developed using the apparatus and terminology related to Stock's vector parameter description of the light beam polarized state. (R.V.J.)

279

ALPHA RADIOACTIVITY OF IRON METEORITES. S. Deutsch and E. Picciotto (Univ. of Brussels) and F. G. Houtermans (Univ. of Berne). Geochim. et Cosmochim. Acta 14, 173-4(1958) Aug.

A nuclear emulsion study of the α activity of iron meteorites is reported. The four meteorites studied were Carbo, Toluca, Tamarugal, and Thunda. Results are tabulated. (L.T.W.)

280

SMALL ANGLE SCATTERING OF X-RAYS BY DEUTERON-IRRADIATED GERMANIUM CRYSTAL. Francisco Eiichi Fujita and Ulrich Gonser (Univ. of Illinois, Urbana). J. Phys. Soc. Japan 13, 1068-9(1958) Sept.

The angular intensity distribution of scattered x rays from an irradiated germanium crystal is given. (auth)

281

SCATTERING OF MICROWAVE RADIATION BY A PLASMA COLUMN. Forrest I. Boley (Royal Inst. of Tech., Stockholm). Nature 182, 790-1(1958) Sept. 20

Experiments are described which were performed to determine the angular distribution of the electromagnetic radiation scattered by the positive column of a mercury discharge under a variety of resonant conditions. The experiments reported prove the multiple order of the three largest resonances investigated to be dipole. (C.H.)

282

AIR SHOWERS OF SIZE GREATER THAN 10^5 PARTICLES. I. CORE LOCATION AND SHOWER SIZE DETERMINATION. M. H. Brennan, D. D. Millar, and C. S. Wallace (Univ. of Sydney). Nature 182, 905-11 (1958) Oct. 4.

An array of radiation detection apparatus was placed on the roof of the University of Sydney School of Physics to provide information on the high-energy nucleon-nucleus interactions of the primary and secondary particles in cosmic showers, interactions which give rise to the development of air showers detectable in the lower atmosphere, and showers of size 10^5 particles to 10^7 particles. A recording and analysis system based on the maximum likelihood method is described. (C.H.)

283

ON THE METHODS OF IONIZATION MEASUREMENT IN G-5 AND K-5 EMULSIONS. G. Cortini (Univ. of Catania and Centro Siciliano di Fisica Nucleare, Catania, Sicily), G. Luzzatto and G. Tomasini (Univ. of Genoa and Istituto Nazionale di Fisica Nucleare, Genoa), and A. Manfredini (Univ. of Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 9, 706-20(1958) Aug. 16.

The results of measurements of ionization made in Ilford G-5 and K-5 photoemulsions by means of a semiautomatic apparatus are reported. The experimental fluctuations are in good agreement with values derived by simple formulas of practical use. While all the models proposed as yet for the mechanism of track formation appear to be oversimplified, an assumption is proposed to explain the results. The different methods of measurement are compared and some suggestions are given. (auth)

284

POWERFUL PULSE ELECTRIC CHARGES IN GASES. D. A. Frank-Kamenetskii. Priroda No. 8, 41-4(1958) Aug. (In Russian)

A short review is given of various aspects of electrical discharge and pinch effect in plasma. (R.V.J.)

285

A GENERAL THEORY OF MAGNETIC RESONANCE SATURATION. Kazuhisa Tomita (Univ. of Kyoto). Progr. Theoret. Phys. (Kyoto) 19, 541-80(1958) May.

A general theory for describing a spin assembly under a nearly resonant rotating magnetic field of arbitrary strength is presented. According to the relation between the static local field strength σ_0 and the characteristic frequency ϕ_0 of fluctuation of the environment two important cases are classified. (A) If the fluctuation of the environment dominates ($\phi_0 \gg \sigma_0$), the equation becomes essentially stochastic in type and relaxation times can be defined in Bloch's sense with a modification that the restoring force is proportional to the deviation not from the canonical distribution under the constant magnetic field but from the canonical distribution under the total magnetic field in an instantaneously static system of coordinates (i.e., the modified Bloch equation holds). (B) If, on the other hand, the static local field dominates ($\sigma_0 \gg \phi_0$), then the transverse lifetime depends essentially on the strength of the rotating field, in fact it is prolonged upon saturation. This leads to a general and reasonable explanation of "saturational narrowing" and the anomalous saturational behavior observed by Redfield and others in the case of nuclear resonance in metals. The same kind of classification applies to the case in which we have two interacting different species of spin, and a general treatment will be given in a forthcoming paper. (auth)

286

AN EXAMPLE OF ISENTROPIC STEADY FLOW IN THE MAGNETOHYDRODYNAMICS. Tosiya Taniuti (Kobe Univ., Japan). Progr. Theoret. Phys. (Kyoto) 19, 749-50(1958) June.

Special solutions of the basic equations of hydromagnetic flow are developed. An isentropic steady state with infinite conductivity is assumed. (D.E.B.)

287

NEGATIVE IONS. N. S. Buchel'nikova. Uspekhi Fiz. Nauk 65, 351-85(1958) July. (In Russian)

Various aspects of negative ions are discussed in relation to their possible use in accelerators. The application in linear accelerators by acceleration of a negative ion beam with the potential +V, transformation of positive ions, and acceleration from +V to zero are described. The adaptation of H^- could simplify the injection of protons on the stable orbit of a synchrophasatron. 191 references. (R.V.J.)

288

IRREGULARITIES IN PLASTIC DEFORMATION OF CRYSTALS. V. N. Rozhanskii. Uspekhi Fiz. Nauk 65, 387-406(1958) July. (In Russian)

Mechanisms of plastic deformations and the problems of microfractures are reviewed. 147 references. (R.V.J.)

289

APPLICATIONS OF COMBINATION SCATTERING ROTATIONAL SPECTRA FOR DETERMINING STRUCTURAL PARAMETERS OF MOLECULES. M. M. Sushchinskii. Uspekhi Fiz. Nauk 65, 441-50(1958) July. (In Russian)

A review is given of the application of combined scattering rotational spectra for determining molecular inertia moments and, on the basis of the obtained magnitudes, to determine the distances between atoms and the valence angles. (R.V.J.)

290

ON THE NEW MASS MEASUREMENTS OF ATOMS. V. A. Kravtsov. Uspekhi Fiz. Nauk 65, 451-88(1958) July. (In Russian)

A review is given of up to date data on atomic masses. Contradictions in atomic mass magnitudes appearing in publications between 1955 and 1958 are discussed. Mass spectroscopic measurements carried out between 1955 and 1957 which helped in reevaluating some previous measurements are described, and measuring methods for uncovering errors in past measurements and developing new more accurate data are suggested. Instances of applications of new values in nuclear physics problems are analyzed and tables of atomic mass values and nuclear bond energies are included. (R.V.J.)

291

THE BROADENING OF LONG ELECTRIC WAVES IN MAGNETIC PLASMAS AND THEIR PASSAGE THROUGH PLASMA LAYERS. Winfried Otto Schumann (Elektrophysikalisches Inst. der TH, Munich). Z. angew. Phys. 10, 428-33(1958) Sept. (In German)

The broadening of electromagnetic waves in damped plasma at "small" frequencies, that is, $\omega < \nu$ (ν is the collision number), is discussed. Without a magnetic field and with a broadening diagonal to the magnetic field, the plasma behaves as a conductor. With broadening along the magnetic field, the plasma also acts as a conductor with $\Omega \ll \nu$. In contrast, with $\Omega \gg \nu$, that is, $\omega \ll \Omega$, both known wave sorts appear, from which the ordinary wave had a negative DK and the extraordinary wave has a positive DK and only poor damping. The electron motion diagonal to the magnetic field behaves in this case as it does in a vacuum in a static field. $\Omega_J \gg \nu_J$ is valid also for ions, so oscillating electrons and ions synchronize with the same amplitude in the same direction and the plasma for frequencies $\omega \ll \Omega_J$ has the active DK 1, as the vacuum. Waves with $\omega \ll \Omega_e$ (but not with $\omega \ll \Omega_J$) along the magnetic field were almost completely reflected at low frequencies to unstable air-plasma transitions against the very high DK of the plasma. In gradual transitions they can pass through with poor damping almost completely unreflected, when the wave length is equal or smaller than the layer thickness or the increase of the layer is at a maximum. (tr-auth)

292

MICROCRYSTALLOSCOPIC REACTIONS IN MELTS. I. M. Korenman and V. P. Kutin (Lobachevsk Gorkii State Univ.). Zhur. Anal. Khim. 13, 423-5(1958) July-Aug. (In Russian)

Microcrystalloscopic reactions for nickel with dimethylglyoxime and α-benzildioxime in melted benzophenone are described as well as for bismuth and lead with quinolineiodoethylate in melted diphenylamine. (tr-auth)

293

RECOMBINATION ON THREE LEVELS OF COPPER ATOMS IN GERMANIUM CONSIDERING THE STATISTICS OF THEIR FILLING WITH ELECTRONS. T. V. Mashovets (Leningrad Inst. of Physics and Technology). Zhur. Tekh. Fiz. 28, 1140-50(1958) June. (In Russian)

The effects of "ordinary" thermal treatment on recombination were investigated. It was assumed that the thermocenters are copper atoms in a state of solid solution replacement. An attempt was made to find cross section values for electron and hole recombination on the admixture levels. (R.V.J.)

294

PENETRATION OF ELECTRONS INTO GERMANIUM AND SILICON. B. Ya. Yurkov (Lebedev Inst. of Physics, Moscow). Zhur. Tekh. Fiz. 28, 1159-64(1958) June. (In Russian)

Calculations were made of the curves for electron energy losses (in approximation of continuous energy losses) for germanium and silicon; the calculated curves were compared to experimental ionization curves. (tr-auth)

295

APPLICATION OF THE STARK EFFECT IN AN ALTERNATING FIELD FOR THE MEASUREMENT OF

ELECTRICAL FIELDS IN A SUPER-HIGH-FREQUENCY DISCHARGE. V. E. Mitsuk (Moscow State Univ.). Zhur. Tekh. Fiz. 28, 1316-25(1958) June. (In Russian)

A method is offered for measuring electrical field intensity in discharge plasma by using the Stark effect. The results of field measurements up to 7.7 kw/cm made on the spectrograph DFS-2 are included. (tr-auth)

296

DYNAMIC AND STATIC MEASUREMENTS OF STRONGLY INHOMOGENEOUS MAGNETIC FIELDS. Bastiaan De Raad. Thesis, Gravenhage, Netherlands, Excelsior, 1958. 143p.

The techniques and instruments used to measure the magnitude and distribution of the flux density in strongly inhomogeneous fields that vary in time are described. The results of the magnetic measurements are given. 122 references. (J.S.R.)

Elementary Particles

297 AECU-3838

Italy. Istituto Nazionale di Fisica Nucleare, Padua; Padua. Universita. Istituto di Fisica and Wisconsin. Univ., Madison.

HYPERFRAGMENTS PRODUCED BY K^0 MESONS FROM K^+ CHARGE EXCHANGE. M. Baldo-Ceolin, H. Huzita, S. Natali, U. Camerini, and W. F. Fry. [1958]. 16p. $3.30(ph OTS); $2.40(mf OTS).

Stacks of C-2 emulsion were exposed to neutral K mesons produced by charge exchange of K^+ mesons in dense material. It was concluded that the hyperfragments were produced by K_2^0 mesons in the K^0 mode. These were generated by the decay of the K_1^0 component of the K^0 beam. Other possible mechanisms of production of the hyperfragments were considered and are shown to be unimportant. (auth)

298 AFOSR-TN-58-830

Stanford Univ., Calif.

HIGH-ENERGY BREMSSTRAHLUNG IN ELECTRON-PROTON COLLISIONS. Technical Report No. 38. R. A. Berg and C. N. Lindner. Sept. 1958. 22p. Contract AF18(600)-545. (AD-202915).

The cross section for the bremsstrahlung resulting from high-energy collisions of electrons with protons is calculated, considering the electrons as extreme relativistic and taking into consideration the proton's recoil, anomalous magnetic moment, bremsstrahlung, and form factors. The final cross section is integrated over the recoil proton and final photon to obtain a formula of interest for the Stanford accelerator experiments. The computation of the integrated cross section made without regard for radiative corrections and mesonic contributions is estimated to be accurate to 2% in the energy ranges of interest. This cross section is corrected for radiative effects, which produce an additional uncertainty of less than 5% and possibly as little as 1%. Resonance effects due to meson interactions in the "virtual Compton effect" diagrams, however, become significant in the range of interest. Their contribution to the cross section is discussed. (auth)

299 CERN-58-19

European Organization for Nuclear Research, Geneva.

BETATRON ACCELERATION OF ELECTRONS IN A PLASMA. P. Reynolds and H. M. Skarsgard. July 1958. 53p.

Betatron acceleration was applied to a plasma by means of an air-cored winding. The plasma was formed initially within a toroidal ring chamber by an r.f. breakdown in gas at pressures from 5×10^{-5} to 2×10^{-3} mm of Hg. Various gases were used. A steady azimuthal magnetic field of up to 1400 gauss was applied during plasma formation and betatron acceleration. Accelerating electric fields of up to 22 volts/cm were employed. X-rays were observed with energies up to 2 Mev, the field energy of the machine. The intensity of x-rays indicates that electrons representing up to 20 amps of circulating current were accelerated within the plasma to energies of about 100 kev. These runaway electrons are associated with much larger conduction currents and are lost at relatively low energies. For lower initial plasma densities, single high-energy x-ray pulses can be produced corresponding to runaway electrons with the full energy of the machine. The circulating current represented by these 2 Mev electrons is about 1 amp. (auth)

300 CNC-1

Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.

CINETICA DEI NEUTRONI LENTI IN UNO SPETTROMETRO A TEMPO DI VOLO. I—PROBABILITA DI TRANSMISSIONE DEI NEUTRONI ATTRAVERSO UNA FENDITURA RUOTANTE. (Kinetics of Thermal Neutrons in a Time-of-Flight Spectrometer. I. Probability of Transmission of Neutrons through a Revolving Slit.) M. Marseguerra and G. Pauli. July 1958. 45p.

The kinetic behavior of thermal neutrons in a time-of-flight spectrometer is examined. An analytical method for obtaining the expressions for the probability for slow neutron transmission through a revolving slit (the general case of a curved slit is considered) is presented and discussed in detail. (auth)

301 KAPL-M-WVJ-4

Knolls Atomic Power Lab., Schenectady, N. Y.

ANNEALING OF IRRADIATED BORON CONTAINING ALLOYS AND DISPERSIONS. W. V. Johnston and J. E. Noonan. May 12, 1958. 10p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The interpretation of the dimensional instability of U—Zr alloy containing small amounts of boron has raised the question of whether the observed low-temperature swelling can be related to the temperature-swelling characteristics of either the U—Zr alloy or Zr—B alloys by themselves. To obtain such information on the Zr—B system to compare with the more detailed study of the alloy early results of which were reported in KAPL-1562, pieces of previously irradiated Zr—B alloys and dispersions were annealed in vacuum at temperatures between 350 and 750°C. (auth)

302 NP-6958

Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.

INVESTIGATION OF REACTION $p + p \rightarrow d + \pi^+$ ON A POLARIZED PROTON BEAM AT ENERGIES 536, 616 AND 654 MEV. Yu. K. Akimov, O. V. Savchenko, and L. M. Soroko. 1958. 25p.

The angular asymmetry dependence in the positive pion emission in the reaction $p + p \rightarrow d + \pi^+$ was measured on a polarized proton beam at the energies: 536, 616, and 654 Mev. The direct evidence that the d-state of mesons is present in the reaction $p + p \rightarrow d + \pi^+$ was obtained. The results of the experiment agree with the assumption that the amplitudes of the S and d transitions are considerably less than that of the transition $^1D_2 \rightarrow {}^3S_1P$. The limiting values of some partial cross sections were estimated. (auth)

303 NP-6965

Joint Institute for Nuclear Research, Moscow.

MULTIPLE PRODUCTION OF PARTICLES IN COLLI-

SIONS BETWEEN 9 BeV PROTONS AND NUCLEONS. V. S. Barashenkov, V. A. Belyakov, E. G. Bubelev, Wang-Shu-fen, V. M. Maltsev, Ten Gyn, and N. D. Tolstov. 1958. 18p.

Some theoretical calculations pertaining to multiple production of particles in nucleon-nucleon collisions at 7 to 10 Bev are compared with results from some new experiments. 372 stars, of which 50 were classified as proton-nucleon collisions, were recorded in NIKFI-R photographic emulsions along the tracks of ≈9 Bev protons accelerated in the JINR proton synchrocyclotron. The mean number of charged particles created in these collisions was 3.6 ± 0.5. The angular distribution of fast charged particles is obtained. As a whole the experimental results agree with the statistical theory of multiple particle production within the limits of the experimental errors. Some discrepancy is evident in the small angle range and may be due to the contribution of noncentral impacts and to asymmetry of the angular distribution in the cms. (auth)

304

A METHOD OF DETERMINING THE NUMBER OF DECELERATED ELECTRONS AND THE ABSORBED ENERGY FOR A MONOENERGETIC ELECTRON BEAM. A. V. Byalobjeskii and V. D. Val'kov. Atomnaya Energ. 5, 68-9(1958). (In Russian)

A method is offered for measuring the quantity of fast electrons decelerated in various parts of a system irradiated by a monoenergetic electron beam. The experiment is made with electrons passing through 6 aluminum discs (195 μ thickness each). Diagrams are shown of the relation between electron absorption and absorber thickness. (R.V.J.)

305

THE DEVELOPMENT AND OPERATION OF A 10kw HOMOPOLAR GENERATOR WITH MERCURY BRUSHES. D. A. Watt (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Proc. Inst. Elec. Engrs. (London) 105, Pt. A, 233-40(1958) June.

Principles of design and the experimental development of a 10 kw homopolar generator with mercury current-collector rings are described. The machine provides pure direct current ranging from 10 to 16 ka at 1.0 to 0.625 v with an estimated efficiency of 91 to 8%, respectively. It has a cylindrical copper rotor and a coaxial compensating conductor of magnetic material. The potentiality of this class of machine in much larger sizes is indicated. (auth)

306

THE DETERMINATION OF THE FUNDAMENTAL STATE OF A SYSTEM OF FERMIONS IN THE DEGENERATE CASE. Claude Bloch and Jules Horowitz (Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette, France). Nuclear Phys. 8, 91-105(1958) Sept. (1)

The linked diagram expansion of the ground state energy and wave function of a system of fermions are extended to the case where the ground state of the unperturbed system is degenerate, as, for instance, in a nucleus with an incomplete shell. The state where all the complete shells are filled is taken as vacuum state. It is then shown, to all orders in the perturbation expansion, that the energy of the first levels is given by the sum of two terms. The first term, is the energy of the core alone and is given by a linked diagram expansion of the usual form. The second term is the energy of the particles outside the core. It is obtained by solving an eigenvalue problem in the space of the degenerate unperturbed wave functions. The corresponding eigen-functions are given by linked diagram expansions very similar with the usual ones. A few generalizations of the method, and its relation to the Brillouin-Wigner perturbation method are discussed. (auth)

307

DETERMINATION OF THE RELATIVE $\Sigma-\Lambda$ PARITY. Gordon Feldman and Thomas Fulton (Johns Hopkins Univ., Baltimore). Nuclear Phys. 8, 106-12(1958) Sept. (1)

An investigation was undertaken to determine whether there are definitive experiments which can determine, at least in principle, the relative $\Sigma-\Lambda$ parity. Two such methods are discussed. They are both based upon the parity-conserving electromagnetic decays of the Σ^0. The first involves the process $\Sigma^0 \rightarrow \Lambda^0+\gamma$. It is necessary to measure the decay asymmetries of the Λ^0 together with the direction of the photon polarization. The second method (also calculated recently by Feinberg) involves an accurate measurement of the branching ratio for the reactions $\Sigma^0 \rightarrow \Lambda^0 + e^+ + e^-$ and $\Sigma^0 \rightarrow \Lambda^0 + \gamma$. The appendix is concerned with some properties of a general vertex part. (auth)

308

ON THE SELF-STRESS OF COMPOSITE PARTICLES. J. Strathdee and Y. Takahashi (Dublin Inst. for Advanced Studies). Nuclear Phys. 8, 113-23(1958) Sept. (1)

It is proved that the Pais-Epstein formula which shows the close relation between self-stress and self-energy holds true even for bound states. This formula is used to show that the self-stress of the composite particle vanishes in the rest frame, i.e. that the binding energy transforms like a mass. This makes it possible for the composite particle models proposed by many authors in connection with strange particles to join company with the relativistic particles. (auth)

309

ANALYSIS OF THE τ-MESON DECAY. H. H. Heckman (Univ. of California, Berkeley). Nuovo cimento (10) 4, Suppl. No. 2, 230-2(1956).

Stacks of Ilfords G.5 emulsions were exposed to secondary particles from a target bombarded by 4.8 to 5.7 Bev protons. A re-entrant well permitted placement of the emulsions at 90° to the beam direction and within 10 inches of the bombarded target. With this geometry the proper flight time for 125-Mev K-particles to be brought to rest in the emulsion was about 1.5×10^{-2} sec. Some of the results obtained from two such exposures are described. (A.C.)

310

ON THE SYMMETRY LAW AND THE PION DECAY. H. Umezawa and H. Miyazawa (Univ. of Tokyo). Nuovo cimento (10) 9, 586-9(1958) Aug. 16.

Assuming the global symmetry of strong pion interactions, a simple combination of the V- and A-types of β-interaction is introduced to explain the problem of the β- and radiative β-decays of the pion. This combination is in good accordance with the rule saying that the weak interactions are invariant under the transformation, under which the nucleon and the Ξ are interchanged and γ_5 appearing in the baryon changes its sign. (auth)

311

SLOW MESONS ACCOMPANYING HIGH ENERGY INTERACTIONS. B. Chamany and A. G. Barkow (Marquette Univ., Milwaukee). Nuovo cimento (10) 9, 590-9 (1958) Aug. 16.

Four nuclear events were found in G-5 emulsions, exposed in Texas at an altitude of 104,000 feet, where the breakup of the primary or the resulting interaction was accompanied by the emission of slow pions. Two of the events could be analyzed as nucleon-nucleon interactions, and the energies of the slow pion produced were (8.06 ± 0.09) and (8.6 ± 0.1) Mev, respectively. On the basis of existing theories on multiple meson production, an attempt was made to calculate the probability of observing the production of a 10 Mev pion or less. Computations for two energies of the incident nucleon were made. When the incident nucleon in the laboratory system of co-ordinates was 1.38 Bev, one meson was produced and the probability that it had an energy of 10 Mev or less was found to be 6 in 100. If the incident nucleon is 11.1 Bev (N = 2), the probability that one meson had an energy of 10 Mev or less was found to be 2 in 1000. (auth)

312

Λ^0- AND Θ^0-PARTICLES PRODUCED IN IRON. G. Alexander, C. Ballario, R. Bizzarri, et al. (Univ. of Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 9, 624-46(1958) Aug. 16.

The results of an experiment on some properties of Λ^0- and θ^0-particles produced in the plates of a cloud chamber are discussed. 115 V^0-events are analyzed by means of angle measurements and ionization estimates. The frequency of production of Λ^0, θ^0-pairs is found to be small. For neither type of particle is any evidence found for anisotropy in the decays. The V^0 production cross-section appears larger for a pion primary than for a nucleon, and increases with the energy released in the shower. (auth)

313

A SEARCH FOR PARTICLES OF 550 m_e. M. Conversi, E. Fiorini, S. Ratti, et al. (Univ. di Milan e di Pisa, and Istituto Nazionale di Fisica Nucleare, Milan e di Pisa.) Nuovo cimento (10) 9, 740-4(1958) Aug. 16.

In the experiment reported, mass determinations are essentially based on measurements of energy loss and range. The apparatus for detecting the particles is described. No 550 mass particles were observed in a time interval during which six could have been expected on the basis of their reported abundance. (W.D.M.)

314

INTERACTIONS AND DECAYS OF K^- MESONS. III. ANALYSIS OF THE STARS IN FLIGHT. Y. Eisenberg, W. Koch, E. Lohrmann, et al. (Univ. of Bern). Nuovo cimento (10) 9, 745-79(1958) Sept. 1.

About 415 interactions of K^- mesons in flight with complex nuclei of the nuclear emulsion have been analyzed. Comparing the results with those obtained by Alvarez et al. from K^-- free proton absorptions at rest, it is concluded that there is a significantly higher fraction of Λ hyperons produced directly through the reaction $K^- + N \rightarrow \Lambda + \pi$, for these stars in flight (average kinetic energy of the interacting K mesons 86 Mev), than must be expected if one transfers the Alvarez results to compound nuclei assuming isotopic spin conservation. If the fraction of directly produced Λ's increases with increasing K^- energy, one could expect also a real increase in the direct Λ production in the K^- absorptions at rest in the nuclear emulsion, because of the Fermi motion of the nucleons. Other topics which are discussed are the energy spectrum and absorption probabilities of the pions and Σ hyperons and also the relative number of hyperfragments observed per Λ hyperon produced. (auth)

315

ENERGETIC HEAVY FRAGMENTS EMITTED FROM NUCLEAR STARS. S. Nakagawa, E. Tamai, and S. Nomoto (Rikkyo (St. Paul's) Univ., Ikebukuro, Tokyo). Nuovo cimento (10) 9, 780-90(1958) Sept. 1.

The authors have investigated the heavy nuclear fragments ($Z \geq 3$) emitted in the cosmic-ray stars of heavy nuclei (Ag, Br) in emulsions by the method of charge determination which was carried out by measuring their track width. It was found that a majority of the fragments were ejected by the nuclear evaporation process, but that also there was a small number of the energetic fragments ($Z \geq 3$) not explained by this process. These energetic ones emitted in the stars (due to Ag or Br nuclei) induced by 6.2 Bev protons from the Bevatron are described. The charge distribution, angular distribution, and energy spectra of those particles were determined. The angular distribution shows strong collimations in the direction of the primary, and significantly differs from that of the evaporated (slow) fragments. The charge distribution gives an exponential decrease with increase in the charge and is similar in form to that of the evaporation process. It seems that the energetic fragments may not be produced by the evaporation process nor by the direct knock-on processes by the primary. It is probable that they may be ejected as the result of intense local heating near the surface of the nucleus during the process of nuclear cascade. (auth)

316

INTERACTION OF NEGATIVE K MESONS WITH PROTONS. G. Ascoli, R. D. Hill, and T. S. Yoon (Univ. of Illinois, Urbana). Nuovo cimento (10) 9, 813-21(1958) Sept. 1.

Ten events of elastic and four events of inelastic scattering of K^- particles by free protons in nuclear emulsions were observed in the K particle energy range from 5 to 70 Mev. These data, when added to those from other laboratories, are consistent with an s-wave interaction between the negative K particle and proton at low K particle energies. A preliminary investigation of the evidence for isotopic spin states 0 and 1 is also made. (auth)

317

ANGULAR DISTRIBUTIONS IN STRANGE PARTICLES TWO BODY DECAYS. M. Jacob (Brookhaven National Lab., Upton, N. Y.). Nuovo cimento (10) 9, 826-33(1958) Sept. 1.

General considerations are developed for the decay of a particle into two particles of arbitrary spins and some formulas are derived. The formalism introduced suits easily parity non-conserving decays. The results obtained are applied to the $K_{\mu 2}$ decay, and a numerical calculation is carried out in the special case of spin 2; the polarization of the emitted μ meson is also discussed. (auth)

318

PHENOMENOLOGICAL DISCUSSION OF THE SCATTERING AND ABSORPTION OF K-MESONS BY PROTONS. J. D. Jackson, D. G. Ravenhall, and H. W. Wyld, Jr. (Univ. of Illinois, Urbana). Nuovo cimento (10) 9, 834-41 (1958) Sept. 1.

A simple phenomenological analysis of the scattering and absorption of low-energy K mesons by protons is presented. An effective range expansion is used to describe the complex phase shifts; s-wave interactions are assumed dominant; only the crudest approximation, that of zero effective range, is illustrated. The scattering and absorption of K^- mesons by protons and the scattering of K^+ mesons by protons are consistent with this zero range approximation. The appreciable fall-off of the K^- elastic scattering cross section with increasing energy as compared to the essential constancy of the K^+ cross section is attributable in large part to the presence of the absorption in flight for K^- mesons. The connection between the cross sections for absorption in flight from states of definite angular momentum and the capture rates from the corresponding bound states is explicitly stated and the possibility of correlating the data from the two sources is discussed. (auth)

319

NUCLEAR INTERACTIONS OF NEUTRAL K-MESONS OF LONG LIFETIME. V. Bisi, R. Cester, A. Debenedetti, et al. (Univ. of Turin). Nuovo cimento (10) 9, 864-79 (1958) Sept. 1.

An emulsion stack was exposed at the Berkeley Bevatron to a neutral beam emitted at 45° with the internal beam entering a Be target. The total distance between stack and target was 6 meters. 9 K^+, 8 particles of strangeness—1, and 4 hyperfragments, all outcoming from stars in emulsion, were found in scanning for interaction products of long lived neutral K. From the relative frequency of particles with different strangeness, the composition of the θ_2^0 beam entering the stack was deduced. The experimental result is compatible with a strangeness mixture of the type proposed by Gell-Mann and Pais. (auth)

320

ON A POSSIBLE TEST OF SYMMETRY IN PION-BARYON INTERACTIONS. D. Amati (Univ. of Rome) and B. Vitale (Univ. of Naples). Nuovo cimento (10) 9, 895-901(1958) Sept. 1.

It is shown that the study of the branching ratios from absorption of low energy K^- on protons (from the continuum) can give a good insight about the symmetries in strong interactions. The possibility of deriving the K-H relative parity from the analysis of high energy absorption processes is also discussed. (auth)

321

ABSORPTION CROSS SECTIONS OF CARBON, IRON AND LEAD FOR 1.5 Gev NEGATIVE PIONS AND 2.8 Gev PROTONS. T. Bowen, M. Di Corato, W. H. Moore, and G. Tagliaferri (Princeton Univ., N. J., Univ. of Milan, Instituto Nazionale di Fisica Nucleare, Milan, and Brookhaven National Lab., Upton, N. Y.). Nuovo cimento (10) 9, 908-19(1958) Sept. 1.

Absorption cross sections of carbon, iron, and lead for high energy negative pions and protons were measured with a multiplate expansion cloud chamber exposed to beams from the Brookhaven Cosmotron. The results are compared to an optical model computation assuming a nuclear potential distribution with the form of the charge density distribution indicated by electron scattering experiments. The measured cross sections appear to agree with the ones deduced using this model from the known values of the free pion-nucleon and proton-nucleon total cross sections. (auth)

322

THE ORIGIN OF COSMIC RAYS. V. L. Ginsburg and M. I. Fradkin. Priroda No. 8, 3-12(1958) Aug. (In Russian)

Cosmic ray origin, motion, and acceleration mechanisms are reviewed. (R.V.J.)

323

THE PHENOMENOLOGICAL MODEL OF THE INTERACTION OF ELEMENTARY PARTICLES. Kanji Fujii and Kenzo Iwata (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto) 19, 475-84(1958) May.

The correlations between the invariant character under the space inversion and the strength of the interactions are displayed by the simple principles, i.e., the composite property of strange particles and the individual Γ_5 transformation invariance. The applications of these principles to lepton processes are satisfactory. The utility of these principles to pull out the future theory is expected. (auth)

324

NOTE ON THE STRANGE PARTICLE EFFECTS IN S-WAVE PION-NUCLEON SCATTERING. Kiyoshi Nakayama (Tohoku Univ., Sendai). Progr. Theoret. Phys. (Kyoto) 19, 581-2(1958) May.

An analysis was made of second-order and d-type terms to determine their effects on S-wave pion-nucleon scattering. The effective potential of the pion was determined by the canonical transformation. This was then inserted in the relativistic Klein-Gordon equation, and the scattering in this potential was calculated exactly. Other parallel procedures are used to obtain the S-wave phase shifts for scattering at the low-energy limit. (D.E.B.)

325

ON THE LATERAL DISTRIBUTION OF THE ELECTRON COMPONENT IN EXTENSIVE AIR SHOWERS. Akira Ueda and Naofumi Ogita (Kyoto Univ. and Kinki Univ., Osaka). Progr. Theoret. Phys. (Kyoto) 19, 582-5(1958) May.

Apparatus of wide span made it possible to measure the lateral distribution of the electron component in air showers. The result shows that the shape of the lateral distribution is practically independent of the shower sizes and altitudes at which observations were made, in agreement with the Nishimura-Kamata (N-K) function of age ≅ 1.3. The results of the investigation are graphically shown. (A.C.)

326

A POSSIBLE SIZE EFFECT ON THE PLASMA OSCILLATION OF ELECTRONS IN SOLIDS. Yoshi H. Ichikawa (Tohoku Univ., Sendai). Progr. Theoret. Phys. (Kyoto) 19, 585-6(1958) May.

Experimental studies of plasma oscillation of electrons in solids were compared with theoretical predictions. A graphical comparison shows fair agreement. (D.E.B.)

327

HYPERON DECAYS AND CHARACTERISTICS OF INTERACTIONS BETWEEN ELEMENTARY PARTICLES. Yukio Taguchi and Rokuo Kawabe (Kyushu Univ., Fukuoka). Progr. Theoret. Phys. (Kyoto) 19, 586-9(1958) May.

The weak interactions describing decays of elementary particles have some regularity and universality. The Fermi-type weak fermion interaction with the same universal coupling constants for parity conserving and nonconserving terms has explained successfully the nuclear β decay and μ-e decay. As for the pion and K-meson decays, it also seems that the universal weak boson fermion interaction of gradient type with the same amount of even and odd parts is more desirable than the direct type coupling. As for the hyperon decays, recent observations on the angular assymmetries have appeared to emphasize a similar tendency. Calculated results are presented in tables and figures. (A.C.)

328

A COVARIANT INTERPRETATION OF THE EXISTENCE OF THE PARITY NON-CONSERVATION AND THE NEW FREEDOMS FOR ELEMENTARY PARTICLES. Ken-iti Goto (Osaka Univ.). Progr. Theoret. Phys. (Kyoto) 19, 592-4(1958) May.

In recent investigations of fundamental properties of elementary particles, parity nonconservation in weak interactions was indicated. A possible covariant interpretation of this is proposed assuming a slight non-Riemann deviation from the Minkowskian structure of space-time. The intention is to introduce a space-time structure with extra fundamental tensors yielding fundamental structural quantity with the transformation of the pseudoscalar. (A.C.)

329
A THEORY OF CLOTHED UNSTABLE PARTICLES. Noboru Nakanishi (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 19, 607-21(1958) June.

The clothed states of unstable particles are investigated on the basis of quantum field theory, and thereby a new mathematical notion, "complex distribution," is introduced. Then the exact eigenstate of total Hamiltonian with the complex eigenvalue, whose real part represents the mass of the unstable particle and whose imaginary part is interpreted as the half reciprocal of its lifetime, can be constructed by means of the complex distribution. But this state is not observable. The physical state of the unstable particle therefore is defined as an approximate state of the exact eigenstate, which exhibits physically reasonable behaviors. (auth)

330
THE POSSIBLE EXISTENCE OF A NEUTRAL MESON WITH ISOTOPIC SPIN 0. Yoshio Yamaguchi (Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 19, 622-30 (1958) June.

The possible existence of a neutral meson with isotopic spin 0 is suggested. Its effects on pion physics and some ways to test its existence are discussed. (auth)

331
ON THE HYDRODYNAMICAL THEORY IN MULTIPLE PARTICLE PRODUCTION. Minoru Hamaguchi (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 19, 741-3(1958) June.

Strong viscosity effects are introduced in covariant form to the hydrodynamic description of multiple particle production. The meson cloud produced in nucleon-nucleon collisions will then behave as if under the influence of a viscous fluid. (D.E.B.)

332
THE COSMIC RADIATION. J. E. Hooper and M. Scharff. London, Methuen & Co., Ltd., 1958. 177p.

The purpose of this book is to provide an introduction to the study of cosmic radiation for students and physicists engaged in other fields. The experimental techniques, high-energy nuclear interactions, high-energy electromagnetic processes, unstable particles in cosmic radiation, degradation of the primary energy in the high atmosphere, and effects at sea level and underground are discussed. (J.S.R.)

Heat Transfer and Fluid Flow

333 HW-56960
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
STUDIES IN HEAT EXCHANGERS COOLED BY RAW COLUMBIA RIVER WATER. D. R. Domen and K. D. Hayden. Aug. 1, 1958. 12p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

In the qualitative scale formation test, two heat exchangers with stainless steel U-tubes and carbon steel baffles were used. Demineralized water at 320°F was used on the primary side. The raw water outlets from the exchangers were 175 and 200°F. In the quantitative scale formation test, a carbon steel concentric tube heat exchanger was used. Dowtherm up to 690°F was used on the primary side and the raw water outlet from the exchangers was 212°F. Tube wall temperatures on the raw water side ran up to 310°F. (W.D.M.)

334 KAPL-M-D1G-TD-2
Knolls Atomic Power Lab., Schenectady, N. Y.
CONTINUATION OF KAPL (D1G) INVESTIGATION OF BURNOUT. (Work done as Contribution to Working Group C of WAPD-CE-KAPL Thermal Design Task Force). J. Longo, Jr. June 16, 1958. 31p. Contract [W-31-109-Eng-52]. $9.30(ph OTS); $3.60(mf OTS).

A continuation of the KAPL (D1G) investigation of burnout is presented. Graphs are presented of the experimental burnout heat flux versus mass velocity for various ranges of enthalpy and L/S. The experimental burnout heat flux divided by the contribution of two of the independent variables are plotted versus the third independent variable. (W.D.M.)

335 KAPL-M-MMS-1
Knolls Atomic Power Lab., Schenectady, N. Y.
BOILING HEAT TRANSFER CORRELATIONS. M. M. Schorr. June 1, 1958. 27p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

A study was made to obtain the best boiling heat transfer correlation applicable to D1G. It was determined that Rohsenow's correlation is the most applicable to the work at present. (auth)

336 KAPL-M-RB-1
Knolls Atomic Power Lab., Schenectady, N. Y.
FLT—FLOW TRANSIENT CODE FOR THE IBM 704. Robert D. Burgess. June 23, 1958. 20p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

An IBM 704 code concerned with loss of flow accidents in a three loop cooling system is described. The statement of the physical problem, equations solved, method of solution, input preparation, and machine operation are included. (auth)

337 LA-2165
Los Alamos Scientific Lab., N. Mex.
A STUDY OF A NUMERICAL SOLUTION TO A TWO-DIMENSIONAL HYDRODYNAMICAL PROBLEM. Alexander Blair, Nicholas Metropolis, John von Neumann, A. H. Taub, and Mary Tsingou. Sept. 28, 1957. 79p. Contract W-7405-Eng-36. $12.30(ph OTS); $4.50(mf OTS).

Results are presented that were obtained on Maniac I when that machine was used to solve numerically a set of difference equations representing the two-dimensional motion of two incompressible fluids subject only to gravitational and hydrodynamical forces. Eulerian coordinates were used. Three appendices taken from handwritten notes of John von Neumann and from his letter to Stanislaw Ulam are included. John von Neumann suggested this study and these notes outline the mathematical approach used on the problem. (auth)

338 WAPD-TH-357
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
HIGH HEAT FLUX TESTS AND BURNOUT TEST ON PARALLEL FLOW RODS. G. Maurer and A. Weiss. [Nov. 1957.] 12p. $3.30(ph OTS); $2.40(mf OTS).

High heat flux tests with no burnout and a single physical burnout were conducted with vertical upflow of water at 200°C psia using a test section having nine heated rods of PWR core 1 blanket size and pitch. These results indicate that the Bettis Thermal Design Procedures of WAPD-SRF-RS-444 are conservative in predicting burnout heat fluxes for flow outside of parallel rod bundles. (J.R.D.)

339 WAPD-TH-408
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
UPFLOW BURNOUT DATA FOR WATER AT 2000, 1200, 800, AND 600 PSIA IN VERTICAL 0.070 IN. × 2.25 IN. × 72 IN. LONG STAINLESS STEEL RECTANGULAR CHANNELS. N. Troy. [July 1958]. 18p. $3.30(ph OTS); $2.40(mf OTS).

Upflow burnout data for water at 2000, 1200, 800, and 600 psia in vertical 0.070 in. by 2.25 in. by 72 in. long stainless steel rectangular channels are presented. The burnout heat fluxes for these channels depend upon the same parameters as did previously tested channels with much smaller L/D ratios. Bettis burnout design equations were used in calculations. (J.R.D.)

340 WAPD-TH-437
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
RESULTS OF VERTICAL UPFLOW PRESSURE DROP TESTS WITH WATER AT 2000 PSIA FOR PARALLEL FLOW THROUGH HEATED ROD BUNDLES. G. W. Maurer and A. Weiss. [Aug. 1958]. 36p. $6.30(ph OTS); $3.00(mf OTS).

Pressure drop tests were conducted with vertical upflow of water at 2000 psia using a test section having nine heated rods of PWR core 1 reference blanket size and pitch (0.413 in. diam by 0.468 in. square pitch by 9¼ in. long). These tests confirmed the validity of using design procedures based on tests with rectangular channels for calculating pressure drop for parallel flow through heated bundles. (J.R.D.)

341 AEC-tr-3393
UNSTEADY MOTIONS OF AN INCOMPRESSIBLE FLUID IN NARROW REGIONS. Iu. L. Yakimov. Translated for Oak Ridge Gaseous Diffusion Plant from Doklady Akad. Nauk S.S.S.R. 115, 1080-3(1957). 9p.

The potential unsteady plane-parallel motion of an incompressible fluid having a free surface in a channel having a flat bottom is discussed. (T.R.H.)

342 AED-tr-3394
UNSTEADY FLOW OF A VISCOUS FLUID BETWEEN PARALLEL POROUS WALLS. D. E. Dolidze. Translated for Oak Ridge Gaseous Diffusion Plant from Doklady Akad. Nauk S.S.S.R. 117, 380-3(1957). 8p.

The steady, two-dimensional laminar flow of a viscous, non-contracting fluid between plane walls when the porosity of the walls is constant is investigated mathematically. (auth)

343 AEC-tr-3423
HEAD-WATER LOSSES DURING MOTION OF WATER AND WATER–SOLID MIXTURE IN LARGE DIAMETER CONDUITS. N. A. Siliń. Translated for Oak Ridge National Lab. from Dopovidi Akad. Nauk Ukr. R.S.R., 2, 175-7(1958). 5p.

The losses in pressure of water during flow in a water-solid mixture through large-diameter conduits were measured. In addition, the water consumption and the specific weight of the water solid mixture were measured. The experimental techniques are described and the results tabulated. (J.R.D.)

344
THERMAL CONDUCTIVITY OF GRAPHITE-SILICONE OIL AND GRAPHITE-WATER SUSPENSIONS. T. B. Jefferson, O. W. Witzell, and W. L. Sibbitt (Purdue Univ., Lafayette, Ind.). Ind. Eng. Chem. 50, 1589-92(1958) Oct.

Conductivities of six concentrations of graphite–silicone oil and four concentrations of graphite–gelled water suspensions were experimentally determined. The results are presented in graphs which also contain theoretical conductivities calculated by several methods, and results obtained by other workers are plotted for comparison. (J.R.D.)

345
ELECTROCONVECTIONAL HEAT TRANSFER IN GASES. Sigurds Arajs and Sam Legvold (Iowa State Coll., Ames). J. Chem. Phys. 29, 631-6(1958) Sept.

Electroconvectional heat transfers have been measured in gaseous N_2, CO_2, NH_3, SO_2, and CCl_3F. The results are interpreted and correlated according to the theories of Kronig and of Senftleben and Bültmann. The theoretical predictions of Senftleben and Bültmann concerning the dependence of the electroconvectional heat transfer on the pressure of the gas and the magnitude of the electric field are found to fit the experimental results. (auth)

346
1958 HEAT TRANSFER AND FLUID MECHANICS INSTITUTE. Preprints of Papers. Held at University of California, Berkeley, California, June 19, 20, 21, 1958. Stanford, Calif., Stanford University Press, 1958. 270p.

Preprints of the twenty-one papers presented are given as a basis for discussion. The titles are: Theoretical Aerothermodynamics; Effect of a Contraction on Turbulence and Temperature Fluctuations; Experimental Investigation of Turbulent Pipe Flow with Coolant Injection; An Analysis of the Energy Separation in Laminar and Turbulent Compressible Vortex Flows; Mass Transfer Cooling with Combustion in a Laminar Boundary Layer; Considerations Related to the Quenching of Flames with Simple Kinetics; Wave Propagation in a Reacting Mixture; Criteria for Thermodynamic Equilibrium in Gas Flow; Compressible Couette Flow with Diffusion of a Reactive Gas from a Decomposing Wall; Boundary Layer Transition and Heat Transfer in Shock Tubes; Heat Transfer and Friction in Swirling Turbulent Flow; Turbulent Heat Transfer on Highly Cooled Blunt Nosed Bodies of Revolution in Dissociated Air; Natural Convection Heat Transfer in Liquids Confined by Two Horizontal Plates and Heated From Below; Drag of a Sphere Moving in a Conducting Fluid in the Presence of a Magnetic Field; On a Class of Magnetic Laminar Boundary Layers; Exploratory Studies of a Spiked Body for Hypersonic Flight; Results from Aerodynamic Studies of Blunt Bodies in Hypersonic Flows of Partially Dissociated Air; Laminar Hypersonic Heat Transfer on a Blunt Body According to the Integral Method; Two-Phase Hypersonic Laminar Boundary Layer—A study of Surface Melting; Thermal Analyses of Stagnant Regions with Emphasis on Heat Sustaining Nose Shapes at Hypersonic Speeds; and Magnetohydrodynamics. (T.R.H.)

Nuclear Properties and Reactions

347 AERE-R/R-2397
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE EXPERIMENTAL DETERMINATION OF CONVERSION FACTORS AND FAST FISSION FACTORS. C. G. Campbell and M. D. Carter. 1958. 9p. (NPCC/RPWP/P-121).

A technique is described for the experimental determination of the initial conversion factor and the fast fission factor of uranium fueled systems. Neutron fluxes down to $\sim 10^7$ n/cm^2-sec are sufficient for the measurements. (auth)

348 CWR-4028
Curtiss-Wright Corp. Research Div., Quehanna, Penna.
THE SCATTERING OF NEUTRONS BY U^{238}. C. E. Mandeville and Devereux L. Kavanagh. June 1958. 36p. \$6.30(ph OTS); \$3.00(mf OTS).

Energy distributions of elastically and inelastically scattered neutrons are considered. The results of the investigation are tabulated. (A.C.)

349 KAPL-1916
Knolls Atomic Power Lab., Schenectady, N. Y.
NEUTRON SPECTRA MEASUREMENTS. R. S. Stone and R. E. Slovacek. Sept. 15, 1957. 30p. Contract W-31-109-Eng-52. \$1.00(OTS).

Thermal neutron spectra were measured with time-of-flight techniques. Spectra were obtained for pure water and for a nearly homogeneous subcritical assembly where the ratio of thermal absorption to high energy scattering cross section was ~ 0.3. For each medium, spectra were measured at 298 and 586°K. The experimental results are presented and compared with calculated theoretical spectra. The agreement between theory and experiment is excellent for the multiplying media. On the basis of this agreement, one concludes that chemical binding effects in light water play a negligible role in determining the equilibrium neutron spectrum in water assemblies. (auth)

350 KAPL-M-WBW-5
Knolls Atomic Power Lab., Schenectady, N. Y.
PERTURBATION OF SPATIAL FLUX DISTRIBUTIONS BY DETECTOR FOILS. W. B. Wright and J. H. Smith. July 1, 1958. 7p. Contract W-31-109-Eng-52. \$1.80 (ph OTS); \$1.80(mf OTS).

In foil measurements of spatial flux transients near water gaps or thin absorbers, the question arises as to the degree to which the detector foils affect the measured quantities. Bothe and others have examined the flux depression created by the measuring foils resulting in an amplitude correction to the observed flux. However, the possibility remains that the foils change the functional form of the flux as well as the amplitude by creating a region (defined by the series of detector foils) with an average cross-section different from that of the lattice under study. An analysis of this effect is presented. (auth)

351 NARF-58-37T
Convair, Fort Worth, Tex.
CALCULATED GAMMA RAY SPECTRA FROM U^{235} FISSION PRODUCTS. John F. Scoles. Aug. 29, 1958. 149p. Project No. 6(1-9964). Contract AF33(600)-32054. (FZK-9-132).

The gamma rays from fission products remaining in a reactor after operation are usually the most important contributors to the dose from a shutdown reactor or spent fuel assembly. To improve the accuracy of shielding calculations, the spectra of these gamma rays were calculated for various combinations of reactor operation time and time after shutdown. A literature survey was performed to obtain U^{235} thermal fission yields and decay information. These data were used in a digital computer program to obtain the gamma ray energy in each of 28 energy groups. The results obtained are substantially more accurate than previous calculations of the same type. The improvement was obtained primarily by using more recently available nuclear data, by extending the length of the decay chains considered, and by a finer division of energy groups. (auth)

352 NP-6962
Joint Institute for Nuclear Research, Moscow.
CHARGE DISTRIBUTION OF EXCITED ISOMERIC NUCLEI AND ATOMIC SPECTRA. (The Nuclear Isomeric Shift). Richard Weiner. 1958. 26p.

Some general theoretical aspects of charge distribution in odd nuclei are studied. Single-particle transitions, and validity of the Rosenthal-Breit perturbation theory are assumed. Under these assumptions it is shown that except for sign, the effect is a pure single particle effect, given by the optical nucleons. The sign of the shift is generally intimately related to the whole nuclear configuration. In the case of two characteristic transitions, it is shown that the order of magnitude of the effect does not depend on the shape of nuclear potential. The general formulas of the shift for odd-even and even-odd nuclei are given. By considering two particular forms of nuclear potential (harmonic oscillator and infinite square well), it is shown that there exists a very simple relation between the shift and the characteristics of the two nuclear states involved. Numerical applications are given for Sn^{115} III, Au^{197} I, Hg^{197} II, and Pb^{207} IV. In the odd-even nuclei the theoretical value of the effect is within the reach of atomic spectroscopy ($\geq 10^{-2}$ cm^{-1}), at even-odd nuclei the shift predicted is at the limit of spectroscopic measurability ($\sim 10^{-4}$ cm^{-1}), but the specific interest of the phenomenon lies here in the possible study of a pure bound neutron-electron interaction. (auth)

353 NYO-2054
Johns Hopkins Univ., Baltimore.
EFFECT OF CHANNEL MIXTURES ON n-γ CORRELATIONS FROM STRIPPING REACTIONS. Steve Edwards, Jr. ANALYSIS OF THE REACTION C^{13}(He^3,α)C^{12}. George E. Owen and L. Madansky. July 1958. 73p. Contract AT(30-1)-2028. \$12.30(ph OTS); \$4.50(mf OTS).

The heavy particle stripping channel was included in the Born approximation stripping theory of n-γ angular correlations for the B^{11}(d,n)C^{12}(γ)C^{12} reaction. Because of the dependence of the relative contributions from the deuteron and heavy particle channels on neutron angle and the variation of the relative orientation of the preferred axes of quantization with neutron angle, the total correlation function is a function of neutron angle. The correlation functions for each channel depend on the coupling scheme assumed for the angular momenta involved in the reaction. An analysis of the C^{13}(He^3,α)C^{12} reaction incorporating the process of heavy particle stripping of an alpha particle with the process of pick up is presented. The results exhibit the characteristics found in the experimental angular distributions. (W.D.M.)

354 ORNL-2292(Vol.1)
Oak Ridge National Lab., Tenn.
A MONTE CARLO CALCULATION OF AIR-SCATTERED GAMMA RAYS. R. E. Lynch, J. W. Benoit, W. P. Johnson, and C. D. Zerby. Oct. 7, 1958. 75p. Contract W-7405-eng-26. \$2.00(OTS).

A calculation is presented of air-scattered gamma rays using the Monte Carlo method of computation. For simplicity, the problem was idealized to have a monoenergetic, monodirectional point source of gamma rays in an infinite body of air. The results of the calculation included the angular distributions, energy spectra, and tissue dose rates at source-detector separation distances of from 5 to 100 ft. A complete parameter survey was completed for source energies from 0.6 to 12 Mev and for beam angles with respect to the source-detector axis of from 0 to 180°. The report is divided into five volumes: Volume 1 gives a complete description of the mathematical procedure used in the calculation, while volumes 2 and 3 present tables of data representing the energy spectra and angular distributions obtained from the calculation. Volumes 4 and 5 present information similar to that in volumes 2 and 3, except that the data have been converted to tissue dose rates. (auth)

355 ORNL-2293
Oak Ridge National Lab., Tenn.
RECOVERY AND HALF-LIFE DETERMINATION OF I^{129}. H. T. Russell. May 24, 1957. 7p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

A simple, rapid, and efficient separation method for the recovery of I^{129} activity is described. Radioactive I^{129}, a product of U^{235} fission through the $Sb^{129}-Te^{129}$ decay chain, was separated and purified for the radioisotope distribution program at Oak Ridge National Laboratory. It was found by mass spectrographic analysis that 51.28 ± 0.05% of the iodine in the product solution is present as I^{129} and that the remaining 48.72 ± 0.05% is stable I^{129}. The I^{129} activity was determined by beta-gamma coincidence counting to be 0.261 μc/ml. The total iodine concentration was ascertained by potentiometric analyses as 2.866 mg/ml. The half life, which is calculated from the above data, is 1.56×10^7 years. (auth)

356 ORNL-2575
Oak Ridge National Lab., Tenn.
REVIEW OF EXPERIMENTAL AND THEORETICAL STUDIES CONCERNING THE AGE OF FISSION NEUTRONS IN HEAVY WATER. M. Tobias. Oct. 17, 1958. 19p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40 (mf OTS).

The most reliable experimental value for the age of fission neutrons to indium resonance in 99.8% D_2O appears to be 109 ± 3 cm^2. Other work is in close agreement, ranging from 104 to 111 cm^2. Simple numerical integration calculations fall in this range. Monte Carlo estimates are likewise in good agreement but the full effects of anisotropic scattering have not yet been included in these calculations. (auth)

357 ORNL-2594
Oak Ridge National Lab., Tenn.
ON THE CONNECTION BETWEEN FLUX AND SLOWING-DOWN DENSITY. Lawrence Dresner. Oct. 20, 1958. 17p. Contract W-7405-eng-26. $0.75(OTS).

Various approximate connections have been suggested between the flux and slowing-down density. The validity of these approximations is investigated by comparison with a particular class of slowing-down problems in which the resonance escape probability can be calculated exactly. (auth)

358
STUDY OF THE NUCLEAR ISOMERS OF INDIUM-116 FORMED BY THE RADIATIVE CAPTURE OF SLOW NEUTRONS. P. C. Capron and A. Vander Stricht (Univ. of Louvain, Belgium). Ann. soc. sci. Bruxelles 71, No. 3, 204-13(1957). (In French)

In order to study the differentiation of the isomeric states at the moment of the creation of capture levels in the complex nucleus, three methods were used: the study of the activity ratios as a function of the distance from the source, the study of the migration distances of neutrons, and the measurement of the resonance energies by the absorption coefficients of neutrons in boron. The corrections were made by considering the resolution time, the effects of autoabsorption, and backscattering. Some differences for the two isomers of In^{116} were found as a function of energy. The periods of the two isomers were determined and were found equal to 14.5 ± 0.4 sec and 55.13 ± 0.27 min. (tr-auth)

359
THE FISSION CROSS-SECTION OF U^{233} AND THE TOTAL EFFECTIVE CROSS-SECTIONS OF As, V, Ta, AND Bi. V. V. Vladimirskii, A. A. Panov, et al. Atomnaya Energ. 5, 69-70(1958). (In Russian)

The fission cross sections and total cross sections of As, Bi, Ta, and V were measured with a neutron spectrometer with a mechanical chopper. The resonance parameters for U^{233} and As are tabulated. (R.V.J.)

360
DETERMINATION OF THE MEAN NEUTRON YIELD IN THE FISSION OF U^{233} BY 14.8 Mev NEUTRONS. A. N. Protopopov and M. V. Blinov. Atomnaya Energ. 5, 71 (1958). (In Russian)

The mean neutron yield in U^{233} fission by 14.8-Mev neutrons was determined relative to thermal neutrons. Results showed that with the value $\nu^T = 2.52 \pm 0.03$ the mean number of neutrons equals 4.4 ± 0.45. (R.V.J.)

361
COULOMB EXCITATION OF DEFORMED u-g NUCLEI. M. Martin, P. Marmier, and J. de Boer (Technischen Hochschule, Zurich). Helv. Phys. Acta 31, 435-80 (1958). (In German)

Electric excitation of the two first rotational levels of Au^{197}, Ta^{181}, Lu^{175}, Tm^{169}, Ho^{165}, Tb^{159}, $Eu^{153,\ 151}$, and $Ag^{109,\ 107}$ was studied using protons of 4.05 Mev. Spins, transition probabilities, and multipolarities, as well as moments of inertia, deformation parameters, and gyromagnetic factors, were deduced from yields and angular distributions of the gamma rays. (auth)

362
ELECTROMAGNETICALLY PERTURBED GAMMA ANGULAR DISTRIBUTIONS OF THE 197 kev TRANSITION IN F^{19}. M. Martin, R. Szostak, and P. Marmier (Technischen Hochschule, Zurich). Helv. Phys. Acta 31, 481-90(1958). (In German)

The perturbation of the angular distribution of the 197-kev gamma rays following inelastic scattering of protons in F^{19} was measured as a function of an external magnetic field for some solid and liquid targets. The influence of electric quadrupole perturbations is discussed and a value of + (3.5 ± 0.5) nuclear magnetons for the magnetic moment of the 197-kev state was determined. (auth)

363
THE EFFECTIVE CROSS SECTION FOR PAIR PRODUCTION BY 6.3 Mev γ QUANTA IN AN ELECTRON COULOMB FIELD. Ch. J. Frei, H. H. Staub, and H. Winkler (Univ. of Zurich). Helv. Phys. Acta 31, 491-510(1958). (In German)

The pair production cross section for γ rays of 6.3 Mev energy in the field of the electron was determined by measuring the ratio of the total, nuclear, and electronic pair cross sections for the pairs of elements Be-Al and Mg-C. Representing the pair formation cross section per atom by $\Phi = r_0^2\ \alpha\ [\Gamma_n (E) \cdot Z^2 + \Gamma_e (E)\ Z]$ it is found that the ratio of electronic to nuclear cross section Γ_e/Γ_n at $E = 6.3$ Mev is equal to 0.5 ± 0.05, very close to the theoretical value 0.4 given by Borsellino. (auth)

364
PROTON-ALPHA REACTIONS IN LIGHT AND HEAVY NUCLEI. P. E. Hodgson (Univ. of Reading). Nuclear Phys. 8, 1-12(1958) Sept. (1).

Nuclear emulsion was irradiated with 45 Mev protons, and measurements made on the tracks of alpha-particles emitted from disintegrations of the light and heavy nuclei. There is a forward excess of energetic alpha-particles in each case, and this can be accounted for by direct interaction processes, for which several possible models are discussed. Conclusions are drawn on the probability of finding alpha-particles in nuclear matter, and on their momentum distribution. (auth)

365

APPLICATION OF THE SERBER POTENTIAL TO LOW ENERGY HYPERON-NUCLEON SCATTERING. D. B. Lichtenberg (Univ. of Hamburg). Nuclear Phys. 8, 13-18(1958) Sept. (1).

Theoretical expressions for the hyperon-nucleon scattering cross sections at low energy are derived which give these cross sections as simple linear combinations of the nucleon-nucleon cross sections. The assumptions necessary for this derivation are: (a) there exists a universal coupling between pions and baryons, and (b) the nucleon-nucleon interaction can be described by a Serber potential. In addition, the approximations must be made of neglecting effects of K mesons and baryon mass differences. The restriction to low energy is necessary because the assumption is needed that the scattering be appreciable only when the hyperon and nucleon are in a state of zero orbital angular momentum. (auth)

366

THE (d, t) REACTIONS AND THE INTERNAL STRUCTURE OF THE TRITON. M. El Nadi and L. Abou Hadid (Cairo Univ.). Nuclear Phys. 8, 51-4(1958) Sept. (1)

From the experimental values of the differential cross sections for $Li^7(d, t)Li^6$ and $Li^7(p, d)Li^6$; $F^{19}(d, t)F^{18}$ and $F^{19}(p, d)F^{18}$, the probability for the existence of the triton in the configuration of a deuteron ground state plus a second neutron was calculated and found to be very small. (auth)

367

PROTON-PROTON SCATTERING WITH UNPOLARIZED BEAM AND TARGET. Kristian Skarsvag (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). Nuclear Phys. 8, 55-60(1958) Sept. (1)

The general form of the scattering matrix in the single-triplet representation is found, and the formulas for the differential cross section, the polarization and the correlation coefficients are derived. (auth)

368

THE LEVELS OF Na^{23} ON THE UNIFIED MODEL. E. B. Paul and J. H. Montague (Atomic Energy Research Establishment, Harwell, Didcot, Berks, Eng.). Nuclear Phys. 8, 61-4(1958) Sept. (1)

In connection with experimental work on the levels of Na^{23}, an attempt was made to describe this nucleus in terms of the rotational model in a way similar to F^{19}. In this case, the model was unexpectedly successful. However, in the case of Na^{23}, spins and parities of only two states are known with certainty and the predictions can not be checked. For this reason only a first trial using reasonable parameters is reported. The results are shown in diagrams and tables. (A.C.)

369

TIME REVERSAL AND POLARIZED NUCLEAR REACTIONS. G. R. Satchler (Clarendon Lab., Oxford). Nuclear Phys. 8, 65-8(1958) Sept. (1)

Providing the interactions responsible are invariant under time reversal, it is shown there is a simple general relation between the spin polarization moments produced in a collision process, and the angular distribution induced by these moments in the time inverse collision. (auth)

370

F^{19} IN THE UNIFIED MODEL. G. Abraham (Atomic Energy Establishment, Bombay) and C. S. Warke (Tata Inst. of Fundamental Research, Bombay). Nuclear Phys. 8, 69-70(1958) Sept. (1)

The energies of the F^{19} levels $I = 1/2, 5/2, 3/2$ of positive parity and the magnetic moments of the $1/2$ and $5/2$ levels are calculated with the unified model, assuming weak coupling. (auth)

371

MAGNETIC ANALYSIS OF THE REACTION $V^{51}(d, p)V^{52}$. F. A. El Bedewi and S. Tadros (Univ. of Alexandria, U. A. R.). Nuclear Phys. 8, 71-8(1958) Sept. (1)

The protons emitted from the bombardment of a thin vanadium target by 8.67 Mev deuterons were analyzed with a magnetic spectrograph and detected by nuclear photographic emulsions. Seven new excited levels in V^{52} were observed at 3.74, 4.27, 4.46, 4.72, 4.92, 5.23 and 5.48 Mev with errors varying between ±0.02 and ±0.03 Mev. The angular distributions of some proton groups corresponding to a number of low lying levels are measured and compared with theoretical curves based on stripping mechanism. For the ground level in V^{52}, the neutron is captured in the $2p_{3/2}$ state. This suggests that in the shell model the $1f_{7/2}$ state lies above the $2p_{3/2}$ state. A spin of 3^+ is proposed for this ground level. (auth)

372

LOW ENERGY LEVELS IN COBALT 60. F. A. El Bedewi and S. Tadros (Univ. of Alexandria, U. A. R.). Nuclear Phys. 8, 79-84(1958) Sept. (1)

The angular distributions of a number of proton groups emitted from the deuteron bombardment with a cobalt target are compared with theoretical curves based on nuclear stripping mechanism. The spins of the ground and first excited levels of Co^{60} are found to be 5^+ and 2^+ respectively. (auth)

373

M1 TRANSITIONS IN ^{141}Pr AND ^{191}Ir. M. C. Joshi, B. N. Subba Rao, and B. V. Thosar (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10) 9, 600-9(1958) Aug. 16.

K-conversion coefficients of the 145 kev transition in Pr^{141} and the 129 kev transition in Ir^{191} were determined to be 0.34 ± 0.035 and 2.1 ± 0.3, respectively. These values are found to be in better agreement with the finite nuclear size corrected values rather than with the point nucleus values. (auth)

374

ON THE MECHANISM OF THE (n, 2n) REACTION AT 14 Mev NEUTRON ENERGY. E. Remy and K. Winter (College of France, Paris). Nuovo cimento (10) 9, 664-78(1958) Aug. 16.

Neutron spectra emitted by Be^9, Mn^{55}, Fe, I^{127}, and Ta^{181} under bombardment of 14-Mev neutrons were measured by using time-of-flight techniques. Continua of the first neutrons are separated from low energy groups due to the second neutrons. Successive emission is predominant for medium weight and heavy nuclei. A possible contribution of simultaneous emission by light nuclei cannot be decided. The conclusion is used to interpret inelastic scattering data from the interaction of 14-Mev neutrons. (auth)

375

INVESTIGATION OF THE DECAY OF POLONIUM-210. Brat Pal Singh, H. S. Hans, and P. S. Gill (Muslim

Univ., Aligarh, India). Nuovo cimento (10) 9, 699-705 (1958) Aug. 16.

The conversion coefficient of 800 kev γ-rays from the decay of Po^{210} was measured, using scintillation methods, at 0.039 ± 0.01. The value of the conversion coefficient was also obtained by the measurement of conversion electrons with an end window type G.M. counter. The absorption curve for electrons is given and its shape has been interpreted in the light of the results of Lagasse and Doyeb. The value of the conversion coefficient obtained in this way is 0.014 ± 0.005. The discrepancy between the two values is due to K and L shell ionization by α-particles. No coincidences were found between the different parts of γ-ray spectrum. (auth)

376

BRANCHING RATIO OF ThC (^{212}Bi). D. Prosperi (C.N.R.N., Rome) and S. Sciuti (Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 9, 734-5 (1958) Aug. 16.

A 2π gridded ionization chamber connected to a 100-channel pulse height analyzer was used in a precise redetermination of the $\alpha/\alpha + \beta$ branching ratio of Bi^{212}. Nickel discs of 10 cm diameter were suspended over about 500 g of aged thorium nitrate in a metal vessel. The decay products deposited themselves spontaneously on the discs, which were kept at 150 volts with respect to the metal vessel. A value of 0.352 ± 0.003 was found. (W.D.M.)

377

PHOTONEUTRONS FROM Au. S. Cavallaro, V. Emma, C. Milone, and A. Rubbino (Univ. of Catania and Centro Siciliano di Fisica Nucleare, Catania, Sicily). Nuovo cimento (10) 9, 736-9(1958) Aug. 16.

In order to extend the experimental knowledge on the photonuclear interaction, the energy spectrum of photoneutrons from gold was studied. A 60-g Au target was irradiated in a collimated 30-Mev bremsstrahlung beam and the neutrons emitted at 90° were detected by proton recoil tracks in Ilford C-2 200 μm emulsions. (W.D.M.)

378

ON THE COLLECTIVE MODE OF INTERNAL MOTION OF THE NUCLEUS TO BE COUPLED WITH THE IRROTATIONAL SURFACE MOTION. Sinobu Nagata, Ryozo Tamagaki, Saburo Amai, and Toshio Marumori (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 19, 495-516(1958) May.

From the analyses of unsatisfactory points in the usual irrotational collective model, it has been considered that there should exist a kind of "internal" rotational collective motion to be coupled with the usual irrotational surface motion. Using Watanabe's method, a generalization of the collective description with redundant variables is developed and it is shown that the introduction of the rotational collective motion is indispensable in describing the collective motion in a closed form consistently. It is confirmed that this rotational mode plays an important role in explaining the discrepancy between the experimental and theoretical values of the effective moments of inertia of nuclei. The fundamental assumption of the various models concerning the moments of inertia is discussed. (auth)

379

REEVALUATION OF THE ELECTRIC QUADRUPOLE MOMENT OF THE DEUTERON. Hajime Narumi, Tadashi Watanabe, and Osamu Nakahara (Kyoto Univ., Japan). Progr. Theoret. Phys. (Kyoto) 19, 591-2 (1958) May.

Recent high-precision experiments by the HD beam magnetic resonance method gave a formula for calculating nuclear quadrupole coupling constants more accurately than former experiments and also more precisely than the experimental value of the pure deuterium molecule. At present, the most accurate value of the quadrupole moment of the deuteron (error 4%) evaluated through the electromagnetic interaction is considered as based upon the theoretical calculation of q obtained by the use of Newell's variational function. A refinement of Newell's method was made which appears to yield an error of only 0.6%. (A.C.)

380

ANTINUCLEON ANNIHILATION AND MULTIPLICITY OF EMITTED PIONS. Ziro Koba (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 19, 594-5(1958) May.

The large cross section and the high multiplicity of emitted pions are the most conspicuous features of nucleon-antinucleon annihilation experiments. A semi-quantitative relation between these two facts is discussed. (A.C.)

381

SINGLE PARTICLE TRANSITION IN NEUTRON INELASTIC SCATTERING BY DEFORMED NUCLEI. Hiroyuki Matsunobu (Tokyo Metropolitan Univ.) and Shiro Yoshida (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 19, 599-606(1958) June.

The contribution from the direct interaction process to the nucleon inelastic scattering changing the intrinsic configuration of the deformed nucleus is investigated. The perturbation calculation, with the zero-range two body force, is carried out using waves distorted by the collective surface interaction. The resulting cross section is small compared with the cross section for the usual rotational excitation and justifies the approximation contained in the latter calculation. (auth)

382

LONG-RANGE SPIN INTERACTION AND THE MEISSNER-OCHSENFELD EFFECT. Robert McCredie May and Max Robert Schafroth (Univ. of Sydney). Progr. Theoret. Phys. (Kyoto) 19, 646-52(1958) June.

It has been suggested, from a perturbation calculation, that an electron gas exhibits the Meissner-Ochsenfeld effect if a special type of spin-dependent interaction between electrons, $g\, e^2 \sigma_1 \cdot \sigma_2/r$, is assumed. It is shown that in fact such a system exhibits only a modified paramagnetism. (auth)

383

NOTE ON HEAVY ION INDUCED NUCLEAR REACTIONS. Ryuzo Nakasima (Osaka City Univ.). Progr. Theoret. Phys. (Kyoto) 19, 743-5(1958) June.

The experimental results of $Na^{23}(N^{4},\alpha p)P^{32}$ and $Na^{23}(N^{14},\alpha 2p)Si^{31}$ reactions are analyzed by means of the compound nucleus model. Although some modification of the compound nucleus model may explain the behavior of the cross section for heavy ion induced nuclear reactions, recent experimental results of the angular distribution seems to be difficult to explain by the compound nucleus model. (A.C.)

384

ELASTIC SCATTERING IN HIGH ENERGY AND IMPULSE APPROXIMATION. Y. Sakamoto and T. Sasakawa (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 19, 745-7(1958) June.

The increasing knowledge of n-p and p-p scattering has made it possible to get an insight into elementary scattering in the energy region up to 310 Mev phenomenologically and up to about 150 Mev theoretically. As a result it has been possible to choose a few sets of phase shifts concerning elementary scatterings. It is possible to make use of these results in applying the impulse approximation to estimate high-energy scatterings. (A.C.)

385
ON THE $|\Delta I| = 1/2$ RULE FOR THE DECAY OF Σ. Kiyomi Itabashi (Tohoku Univ., Sendai). Progr. Theoret. Phys. (Kyoto) 19, 747-8(1958) June.

Isotopic spin selection rules in the decays of strange particles have been investigated and it has been strongly suggested that in these decays the interactions of the type of $|\Delta I| = 1/2$ are dominant. The branching modes of Σ^0 decay are partially explained by the rule $|\Delta I| = 1/2$. The experimental data for the ratio of the lifetimes Σ^- and Σ^+ and the branching ratio between the two modes of Σ^+ decay are not inconsistent with the rule. This rule can never be absolute, since it can not explain the data concerning K-meson decays. (A.C.)

386
EXPERIMENTAL RESULTS ON CHARGE-CHANGING COLLISIONS OF HYDROGEN AND HELIUM ATOMS AND IONS AT KINETIC ENERGIES ABOVE 0.2 kev. Samuel K. Allison (Univ. of Chicago). Revs. Modern Phys. 30, 1137-68(1958) Oct.

Experimental results on charge-changing collisions of hydrogen and helium are reviewed. Theoretical attempts to compute the charge-changing cross sections are not discussed, but a list of theoretical papers is given as a separate bibliography. (W.D.M.)

387
MEASUREMENTS WITH A PROPORTIONAL COUNTER ON BETA DISINTEGRATION. Hendrik Lourens Hagedoorn. Thesis, Gravenhage, Netherlands, Excelsior, 1958. 72p. (In Dutch)

Measurements of the L/K capture ratios of nuclei decaying by electron emission only and measurements of the EC/β^+ ratios of nuclei decaying by electron capture and positron emission both are reported. The decay energy of Pb^{203} was measured as 930 ± 40 kev, and that of Tl^{202} as 900^{+750}_{-150} kev. The percentage of positron emission was determined for Na^{22}, V^{48}, and Ni^{57}. The fluorescent yield of the K shell for Ti and Co were also determined. The measurements were made with a proportional counter in coincidence with a scintillation spectrometer. 45 references. (J.S.R.)

Theory

388 CERN-58-23
European Organization for Nuclear Research, Geneva. INTRODUCTION TO FIELD THEORY. (Lectures given to the Experimental Physicists at CERN). Victor F. Weisskopf. Sept. 15, 1958. 135p.

Notes are given from a series of lectures on "Field Theory" at CERN. The lectures were part of an introductory course for experimental physicists. (A.C.)

389 KAPL-1651
Knolls Atomic Power Lab., Schenectady, N. Y.
ANALOG COMPUTING EQUIPMENT FOR ANALYSIS OF NEUTRON CROSS-SECTION DATA. R. W. Hockenbury, C. R. Pierce, and M. L. Yeater. Mar. 7, 1958. 21p. Contract W-31-109-Eng-52. $0.75(OTS).

An analog computer was adapted to the analysis of neutron cross-section data. The components and their associated equipment are described. Procedures were developed for curve-fitting, area analysis, resolution functions, and multilevel calculations. (auth)

390 NP-6957
Joint Institute for Nuclear Research, Moscow and Akademiia Nauk S.S.S.R. Institut Matematiki im V. A. Stelkov.
NEW METHOD IN THE THEORY OF SUPERCONDUCTIVITY. N. N. Bogolubov, V. V. Tolmachov, and D. V. Shirkov. June 1958. 81p.

The method of canonical transformations is generalized to Fermi systems and forms the basis of a method for investigating the problem of superconductivity. Starting from Fröhlich's Hamiltonian, the energy of the superconducting ground state and the one-Fermion and collective excitations corresponding to this state are obtained. It turns out that the final formulas for the ground state and one-Fermion excitations recently obtained by Bardeen, Cooper, and Schrieffer are correct in the first approximation. The physical picture appears to be closer to the one proposed by Schafroth, Butler, and Blatt. The effect on superconductivity of the Coulomb interaction between the electrons is analyzed in detail. A criterion for the superfluidity of a Fermi system with a four-line vertex Hamiltonian is established. (auth)

391 NP-6959
Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.
RENORMALIZATION IN THE THEORY WITH INDEFINITE METRIC. B. V. Medvedev and M. K. Polivanov. 1958. 25p.

Recently a variant was suggested for constructing the regular field theory by means of indefinite metric. The finite renormalizations in such a theory are investigated. This investigation is of interest because it is directly associated with the concept of the field origin of the mass of elementary particles. (W.D.M.)

392 NP-tr-157
ON THE THEORY OF EXCITON EXCITED STATES. V. S. Calishev and S. V. Vonsovskii. Translated for Mass. Inst. of Tech., Lincoln Lab. from Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R. Ural. Filial 3, 395-405 (1956). 18p.

The Bogoliubov theory is generalized to the case of exciton excited states. It is shown that the quantum states of a system of weakly-excited excitons in a crystal lattice can be interpreted as a set of individual elementary excitations (excitons). The relation between the theory developed and the Frenkl' theory is indicated. (auth)

393
ABSORPTION AND LUMINESCENCE BY A HARMONIC OSCILLATOR. B. I. Stepanov and V. P. Gribkovskii (Inst. of Physics and Math., Academy of Sciences, Bessarabian SSR). Doklady Akad. Nauk S.S.S.R. 121, 446-9(1958) July 21. (In Russian)

Quantum mechanical estimates of the absorption power and luminescence of linear harmonic oscillators showed that all derivations of the classical theory for harmonic oscillator integral absorption and luminescence coincide with the derivation obtained within the limits of quantum theory. (R.V.J.)

394
ERROR OF DIRECT METHODS IN THE NON-LINEAR THEORY OF SHELLS. I. I. Vorovich (Rostovon Don State Univ.). Doklady Akad. Nauk S.S.S.R. 122, 196-9 (1958) Sept. 11. (In Russian)

Variation methods of solution for strong deformations in shells are analyzed. (R.V.J.)

395

INVARIANT IMBEDDING AND NEUTRON TRANSPORT THEORY. II. FUNCTIONAL EQUATIONS. Richard Bellman, Robert Kalaba, and G. Milton Wing (Rand Corp., Santa Monica, Calif. and Los Alamos Scientific Lab., N. Mex.). J. Math. and Mech. 7, No. 5, 741-56(1958) Sept.

396

SHORT RANGE FORCES AND NUCLEAR SHELL THEORY. Marcos Moshinsky (Univ. of Mexico). Nuclear Phys. 8, 19-40(1958) Sept. (1).

A procedure is developed for obtaining, in nuclear shell theory, the matrix elements associated with short range interactions between nucleons. It is shown that potentials of arbitrary range, both central and spin dependent, can be developed in terms of a series of velocity dependent potentials in increasing powers of the momentum, but all of zero range. The coefficients of the terms in this series are the successive moments of the potential; thus, for short range forces, only the first few terms of the series will be relevant. All the matrix elements for two nucleons in the same shell and in LS coupling, up to terms containing the first moment of the potential, are obtained. The matrix elements for central spin-orbit coupling and tensor forces, are compared, taking for the interaction potential between nucleons, a value recently proposed. (auth)

397

THE USE OF AN EFFECTIVE THREE-BODY POTENTIAL IN THE NUCLEUS. E. J. Squires (Atomic Energy Research Establishment, Harwell, Didcot, Berks, Eng.). Nuclear Phys. 8, 41-50(1958) Sept. (1)

A discussion is given of the possibility of taking into account the state dependence of the Brueckner t-matrix by using an effective potential containing a three-body force. It is shown that this can be chosen so that the binding energy and its density dependence and also the single particle energies are given correctly. The contribution of the three-body force to the binding energy per particle is shown to be about 17 Mev if the Brueckner and Gammel calculations of the t-matrix are used. (auth)

398

SOLUTION OF THE TIME-DEPENDENT THERMAL NEUTRON DIFFUSION EQUATION. LaMar L. Deverall (Univ. of California, Livermore). Nuclear Sci. and Eng. 4, 495-8(1958) Sept.

A Laplace transform method is given which does not assume the neutron spatial distribution to be described by the fundamental eigenfunction. This allows the solution of problems in which the eigenfunction description is not possible. (D.E.B.)

399

DISPERSION RELATIONS FOR FORM FACTORS. Y. Nambu (Univ. of Chicago). Nuovo cimento (10) 9, 610-23(1958) Aug. 16.

Dispersion relations for form factors are studied in perturbation theory. In particular, the relations are proved for a realistic nucleon in the form usually assumed. It is demonstrated, however, that in more general cases the mass spectrum in the dispersion relations depends on the masses of the contributing particles in a peculiar way, which is different from the simple relation hitherto believed. Such a situation arises, for example, in the case of some hyperon models and bound systems such as the deuteron. A formula concerning the final state interaction to be used in conjunction with the dispersion relations is also derived from the invariance of the theory under space-time reversal. (auth)

400

A NEW POSSIBLE THEORY OF THE μ-MESON. I. Ulehla (Joint Inst. of Nuclear Research, Moscow). Nuovo cimento (10) 9, 679-93(1958) Aug. 16.

A theory is presented of the μ-meson as a particle with spin ½ described by anomalous equations differing from the Dirac equations. Calculation is carried out of the intrinsic magnetic moment of the μ-meson, the cross-section for Coulomb and Compton scattering, the self-energy, and the electrodynamic correction to the magnetic moment. An explanation is given of the similarity of the μ-meson and electron at low energies and their dissimilarity at very high energies in electromagnetic interaction. The difference in the masses of the electron and μ-meson is determined by means of the same electromagnetic cut-off for both particles. (auth)

401

ON CONVERGENCE TO THE MUELLER WAVE OPERATORS. M. N. Hack (Argonne National Lab., Lemont, Ill.). Nuovo cimento (10) 9, 731-5(1958) Aug. 16.

It is proved that from the standpoint of the stationary-state formulation of scattering theory, the results of J. M. Cook are expected to remain valid for potentials which fall off at large r faster than $1/r$, and which are required to be square integrable only in the finite domain. (W.D.M.)

402

STRONG COUPLING NUCLEON'S PROPAGATOR. L. M. Garrido (Junta de Energia Nuclear, Madrid). Nuovo cimento (10) 9, 822-5(1958) Sept. 1.

A method is presented to approximate a solution to the equation of the propagator of the stationary nucleon strongly coupled to the pion field. As an example, the procedure is applied to the well known case of neutral pions. (auth)

403

THE Λ-HYPERON-NUCLEON PROBLEM FROM MESON THEORY. F. Ferrari and L. Fonda (Univ. of Padua and Univ. of Trieste). Nuovo cimento (10) 9, 842-63(1958) Sept. 1.

A discussion of the implications of the meson theory with regard to the binding of the Λ-hyperon in nuclear matter is carried out taking explicitly into account the phenomenological results of Dalitz and Downs. The interactions through pions and K mesons are analyzed, considering all possible combinations of the parity of the Σ hyperon and the K meson. Particular attention is devoted to the case of a universal pion-baryon interaction. In this case one is led to the conclusion that the K meson is pseudoscalar. Another solution to the problem can be obtained assuming that the Σ hyperon has different parity from that of the Λ hyperon. This implies that the K-meson contribution to the Λ nucleon potential is of the same order of magnitude as that of the pion field. It is argued that no other solutions can be given. In particular the interaction through the K-meson field only is not able to give agreement with experiment. The stability of the (Ξ, nucleon) and (Σ, nucleon) systems are also briefly discussed. (auth)

404

OBSERVATION IN QUANTUM MECHANICS. H. S. Green (Dublin Inst. for Advanced Studies). Nuovo cimento (10) 9, 880-9(1958) Sept. 1.

An explanation of how the indeterminacy of a quantum-mechanical observable is removed by the process of measurement is given. It is pointed out that the observation of an individual micro-system is possible only by means of its interaction with a macroscopic system in a metastable state. An interaction of this kind is studied quantum-mechanically. The model consists of a particle with two spin states which are split and brought into interaction with separate detectors. Each detector comprises two sets of oscillators at different temperatures, which become coupled by interaction with the particle, so that the latter can be detected by a temperature change. It is found that states in which the spin is indeterminate cannot affect either detector, and that they are rapidly suppressed when the interaction is "switched on." After the interaction, the state of the particle is no longer pure, and can no longer be represented by a single wave function. There is no discontinuity in the transition. (auth)

405

REPRESENTATIONS OF SYMMETRY OPERATORS. P. G. Federbush and M. T. Grisaru (Princeton Univ., N. J.). Nuovo cimento (10) 9, 890-4(1958) Sept. 1.

Explicit representations in terms of the field variables are given for the charge conjugation, space inversion, and time reversal operators for the case of free fields. These expressions are generalized to the case of coupled fields. (auth)

406

A NEW REPRESENTATION FOR BARYONIC FIELDS AND STRONG INTERACTIONS. B. d'Espagnat (CERN, Geneva). Nuovo cimento (10) 9, 920-3(1958) Sept. 1.

Strong interactions may be split into two parts, the very strong (VS) and medium strong (MS) interactions. A very general and somewhat striking formal analogy is pointed out between this splitting the familiar distinction between parity conserving and parity non-conserving interaction terms. A change of representation is introduced, by means of which the VS and MS interaction lagrangian is brought into expressions that differ from each other only by the presence of a supplementary γ_5. (J.S.R.)

407

THE CONSERVATION LAWS IN THE LEPTON PROCESS AND TWO KINDS OF NEUTRINOS. Ichiro Kawakami (Rikkyo Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 19, 459-69(1958) May.

An attempt is made to forbid the unwanted processes involving leptons by assuming the conservation law of lepton number and that of neutrino charge. To do this, suitable assignment of these quantum numbers to each lepton is necessary in addition to the assumption of the existence of two kinds of neutrinos (a right circularly polarized neutrino and a left polarized neutrino). The neutrinoless lepton processes are successfully forbidden, except for the lepton pair processes, and the theoretical predictions for the $\pi-\mu-$e-decay and the β-decay agree well with experiment. In the $\pi-\mu-$e-decay and the β-decay, the vector and axial vector couplings are preferable if the interaction Hamiltonians are written in the form of charge exchange theory. The other sort of unwanted processes than neutrinoless ones, $\pi \to e + \nu$ and $\pi \to e + \nu + \gamma$, are relatively (or dynamically) forbidden from the view-point of the universal Fermi interaction. (auth)

408

THE SPIRALITY OF THE DECAY PRODUCT. Kanji Fujii and Kenzo Iwata (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto) 19, 589-91(1958) May.

Choosing V-A coupling for all weak interactions, it is shown that the spiralities of decay products have simple regularity. The interaction hamiltonian is developed. (D.E.B.)

409

CLUSTER EXPANSION OF THE GROUND STATE OF A BOSE PARTICLE SYSTEM. Fumiaki Iwamoto (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 19, 595-7(1958) May.

Jastrow's variational method was used to obtain an expression for ground state energy which is very similar to the expression developed in considerations of a hard-sphere Bose gas at low density. (D.E.B.)

410

QUANTUM-MECHANICAL MANY-BODY PROBLEM WITH HARD-SPHERE INTERACTION. Ryuzo Abe (Tokyo Inst. of Tech., Oh-okayama, Meguro). Progr. Theoret. Phys. (Kyoto) 19, 699-712(1958) June.

Theory of the surface charge pseudopotential for the hard-sphere potential is developed. It is shown that the formulas known to be exact are obtained by the present method. The excitation energy spectrum of the Bose system is calculated, and is shown to have the nonmonotonic behavior similar to the roton spectrum in liquid He^4. The dispersion formula for the sound velocity is calculated and compared with that derived by Landau and Khalatonikov. (auth)

411

QUANTUM MECHANICS OF STRONGLY INTERACTING PARTICLES WITH AN APPLICATION TO LENNARD-JONES POTENTIAL. Ryuzo Abe (Tokyo Inst. of Tech., Oh-okayama, Meguro). Progr. Theoret. Phys. (Kyoto) 19, 713-24(1958) June.

The perturbation theoretic procedure is developed for a system of strongly interacting particles, by replacing the singular potential with an equivalent operator. As an application of the method, an expression for the ground state energy of a Bose system, which corresponds to Lenz's formula for the hard-sphere system, is obtained for the Lennard-Jones potential. The cohesive energy of liquid He^4 is calculated and is shown to be about twice as large as the experimentally observed one. Some difficulties arising from the negative value of the scattering length are discussed, and it is suggested that the assumption, usually taken for Bose system, that nearly all the particles are in the single particle state with momentum 0 should be altered for the actual liquid He^4. (auth)

412

GENERAL SOLUTION OF THE BETHE-SALPETER EQUATION IN INSTANTANEOUS INTERACTION APPROXIMATION. S. N. Biswas (Univ. of Adelaide). Progr. Theoret. Phys. (Kyoto) 19, 725-39(1958) June.

The Bethe-Salpeter equation is solved for general values of the angular momentum, using only the ladder approximation and the instantaneous interaction approximation. It is first reduced to a set of coupled equations for the singlet and triplet amplitudes, and these are further reduced to the corresponding Schrödinger equations. The non-relativistic potentials are deduced and are found to contain automatically a "core" singularity and spin orbit coupling terms, which are necessary to account for experimental data. The coupling constant, which is the only adjustable parameter, is fitted to the deuteron binding energy, and the potentials are compared with phenomenological potentials. Satisfactory agreement is obtained. (auth)

413

A THEORY OF LEPTON WHICH IS INVARIANT UNDER SPACE INVERSION. Katsuhiko Sekine (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto) 19, 740-1(1958) June.

The proposed theory is consistent with recent asymmetry and polarization experiments, the two-component neutrino theory is not required, and the law of parity conservation is not abandoned. (D.E.B.)

414
THEORETICAL RESULTS ON ORBITAL CAPTURE.
H. Brysk and M. E. Rose (Oak Ridge National Lab., Tenn.). Revs. Modern Phys. 30, 1169-77(1958) Oct.

A discussion of transition probabilities and branching ratios is presented. Transition probabilities are explicitly written down for the K shell and the L subshells for allowed through second-forbidden captures. The relative contributions of capture by the various subshells and of positron emission are examined in detail. The procedure used in obtaining the electron wave functions is outlined. (W.D.M.)

415
ON DETERMINATION OF MAGNETIC AND ELECTRIC FIELDS OF THIN LAYERS AND SHELLS. L. A. Tseitlin. Zhur. Tekh. Fiz. 28, 1326-9(1958) June. (In Russian)

Special functions are developed in which the fine layers or shells are considered in the problem solution. This is accomplished by respective transposition of the boundary conditions on the surface of the layer, excluding the values expressing the field of the layer and establishing a direct relation between the values describing the field on both sides of the layer. The method is applied to magnetic field problems. (R.V.J.)

RADIATION EFFECTS ON MATERIALS

Refer also to abstract 495.

416 ANL-5855
Argonne National Lab., Lemont, Ill.
IRRADIATION OF PROTOTYPE CP-4 (EBR-I) REACTOR FUEL SLUGS IN THE CP-3' GOAT HOLE.
Final Report of Metallurgy Division Program 6.1.1.
S. H. Paine, P. J. Persiani, and W. F. Murphy. Aug. 1958. 24p. Contract W-31-109-eng-38. $0.75(OTS).

Experiments are described which studied the effect of irradiation upon small U^{235} cylinders simulating in size those designed for the initial CP-4 (EBR-I) fuel loading. Qualitative similarities between thermal cycling and irradiation effects were found, but none of the three types of material tested were entirely dimensionally stable. (auth)

417 CF-58-2-109(Rev.)
Oak Ridge National Lab., Tenn.
PHASE I—FOREIGN REACTOR FUEL SAMPLE IRRADIATION OF $U-S_1-Al$ ALLOY. IRRADIATION REQUEST ORNL-MTR-35. C. F. Leitten and W. C. Thurber. Oct. 13, 1958. 19p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The following data summarize the results of calculations presented in this report to determine the irradiation testing for Phase I of Irradiation Request ORNL-MTR-35. This phase of the program entails exposure of a 48 wt. % U-3 wt. % Si-49 wt. % Al alloys in the beryllium reflector of the MTR. (auth)

418 CF-58-10-20
Oak Ridge National Lab., Tenn.
PHASE II—FOREIGN REACTOR—FUEL SAMPLE IRRADIATION OF UC_2-Al DISPERSIONS. IRRADIATION REQUEST ORNL-MTR 35. C. F. Leitten and W. C. Thurber. Oct. 17, 1958. 16p. Contract W-7405-Eng-26. $3.30(ph OTS); $2.40(mf OTS).

The irradiation of miniature fuel plates in the beryllium reflector of the MTR to burn-up values of 20, 40, 60, and 80% of the U^{235} atoms is described. The fuel plates consisted of a 20% enriched, 60 wt. % dispersion of UC_2 in aluminum as the core material which was sealed hermetically in 1100 aluminum by hot-rolling. (W.D.M.)

419 FICO-110
Ford Instrument Co., Long Island City, N. Y.
FISSION PRODUCT DIFFUSION INVESTIGATION FOR CLOSED CYCLE GAS COOLED REACTOR PROGRAM.
Sept. 1958. 38p. Contract AT(30-3)-512. $6.30(ph OTS); $3.00(mf OTS).

A continuation of pellet irradiation work is described. The scope of work was expanded to include in-pile irradiation of the enriched UO_2 pellets in a CO_2 atmosphere in addition to the helium atmosphere arrangement previously described. Gas samples from each pellet experiment were analyzed to determine the nature of any fission product activity. The apparent incompatibility of CO_2 and stainless steel at elevated temperatures is discussed and photographs of test results are included. (auth)

420 IDO-16483
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
RADIATION DAMAGE STUDIES OF BORON STAINLESS STEEL. Interim Report. H. T. Watanabe and W. O. Schaffnit. Sept. 18, 1958. 19p. Contract AT(10-1)-205. $0.75(OTS).

With the use of boron stainless steel in control rods in a reactor, it is important to know whether the operating conditions of temperature and radiation will effect changes in mechanical properties and dimensions and to know the magnitude of such effects if they occur. Tensile specimens of 18-8 stainless steel containing 1% boron, enriched to 93% in boron-10, were fabricated and irradiated in the Materials Testing Reactor to 15 and 25% burnup of boron-10. These were tested for tensile strength, hardness, and elongation and examined metallographically to observe changes in microstructure. The irradiated material was extremely brittle, and areas that appeared to be vacancies were seen in the photomicrographs. (auth)

421 KAPL-1965
Knolls Atomic Power Lab., Schenectady, N. Y.
THE EFFECT OF TRANSIENTS AND LONGER TIME ANNEALS ON IRRADIATED URANIUM-ZIRCONIUM ALLOYS. William V. Johnston. Oct. 3, 1958. 23p. Contract W-31-109-Eng-52. $0.75(OTS).

Small pieces of Zircaloy-clad 7 and 8 wt. % uranium-zirconium alloys irradiated from 0.4 to 1.5 at. % burnup of the total core atoms in the MTR were heat-treated at temperatures between 510 and 980°C for periods of time from 1 sec to 500 hr. The resulting changes in density, electrical resistivity, and microstructure were observed. The core volume changes were found to be a function both of temperature and time at temperature for a given burnup. A decrease in the swelling rate with time was observed. Thus, at 620°C, about 40% of the core volume change after 300 hr (37%) occurred in the first 6 hr. At lower temperatures, more time was required for an equivalent fractional volume change. Metallographic changes and gas bubble formation at phase boundaries were observed optically at temperatures as low as 510°C in high burnup material. Bubbles were also observed in the electron microscope. The changes observed appear to be due to the growth of inert gas bubbles formed in the epsilon phase of uranium-zirconium alloy and to a transformation occurring in the delta phase. The effect of irradiation temperature and flux on the nucleation and growth of the gas bubbles is discussed. (auth)

422 KAPL-M-RLM-17
Knolls Atomic Power Lab., Schenectady, N. Y.
EFFECT OF NEUTRON IRRADIATION ON THE ROOM TEMPERATURE TENSILE PROPERTIES OF ZIRCALOY-3. R. L. Mehan. July 9, 1958. 20p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Zircaloy-3 tensile specimens removed from 25% cold-rolled and annealed plate in both the longitudinal and transverse directions were irradiated at the MTR at temperatures of 115°F and to integrated fast neutron fluxes ranging from 1.2×10^{20} nvt to 3.4×10^{20} nvt. There were indications that saturation of radiation damage may have been reached, although more experimental work is needed to verify this effect. The uniform elongations were reduced by 77 and 100% in the longitudinal and transverse directions, respectively. (auth)

423 SCR-52
Sandia Corp., Albuquerque, N. Mex.
FACTORS IN THE DESIGN OF AN ENVIRONMENTAL CHAMBER INSIDE OF A REACTOR IRRADIATION CELL. T. B. Morse. Oct. 1958. 12p. Contract AT-(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

Presented at Institute of Environmental Engineers, Third Annual Meeting, New York, April 1958.

Sandia Corporation is in the process of designing and procuring a 5-Mw reactor having a maximum fast neutron flux of 10^{11} neutrons per square centimeter per second. In addition to the usual tubes inside the reactor proper for testing small samples, there will be an irradiation cell in which the reactor will be located. This room, 30 feet × 22 feet × 9 feet, will have tracks on 2-foot centers upon which carts may be rolled to any location in the irradiation cell for variations of flux density at constant reactor flux level. The design and materials for this cell are described. (W.L.H.)

424 AEC-tr-3410
ATMOSPHERIC CORROSION OF METALS UNDER RADIATION. A. V. Byalobzheskii. Translated by Lydia Venters (Argonne National Lab.) from Doklady Akad. Nauk S.S.S.R. 119, 515-17(1958). 8p.

The effect of radiation on the corrosion of iron, copper, aluminum, stainless steel, and zinc in air atmosphere at 98% relative humidity was studied. Results indicate that no corrosion occurs in a dry atmosphere. During irradiation under atmospheric conditions corrosion takes place underneath the moist film appearing on the surface of the metal as the results of condensation or adsorption of water vapor, and consequently this corrosion bears an electrochemical nature as does the usual atmospheric corrosion. Data presented show that nitrogen, inert under general conditions, under radiation turns into a corrosion activating agent. The activation of nitrogen takes place only in the presence of oxygen, and consequently is attributed to the formation of its oxygen products, with the predominant one being N_2O_5. (C.H.)

425
THE ABSORPTION OF γ-RAYS FROM POINT SOURCES AND EXTENDED SOURCES IN WATER. G. V. Gorshkov and V. M. Kodyukov. Atomnaya Energ. 5, 71-3(1958). (In Russian)

Studies were made of water attenuation of γ radiation emitted from volume and point sources, $Na^{24}(E_\gamma = 1.38$ and 2.76 Mev) and $Au^{198}(E_\gamma = 0.411$ Mev). The graphical scheme of the experiment is presented. (R.V.J.)

426
RADIOACTIVE METALS LABORATORY. METROVICK BUILDS FIRST PRIVATELY-OWNED HOT FACILITY IN THE U. K. Nuclear Power 3, 502-3(1958) Oct.

The Metropolitan-Vickers Electrical Co., Ltd. laboratory at Wythenshawe, built and equipped for investigating the effects of radiation on reactor materials, is described. (W.D.M.)

427
RADIATION DAMAGE RESISTANCE OF SOME RARE EARTH CERMETS. W. K. Anderson and D. N. Dunning (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 4, 458-66(1958) Sept.

Europium oxide and gadolinium oxide-stainless steel cermets in ranges of 5 to 30 wt. % rare earth oxide were irradiated in the MTR. Free beam bend samples of 5, 20, 25, and 30 wt. % Eu_2O_3-stainless steel cermets and 14 wt. % Gd_2O_3-stainless steel cermets were irradiated in the MTR for times ranging from 2 to 5 cycles. Little damage was noted in the irradiated Gd_2O_3-stainless steel cermets after irradiation. Damage to the irradiated Eu_2O_3-stainless steel cermets appeared to be a function of radiation time and concentrations. Metallographic samples of unirradiated and irradiated samples representing each test are included. (auth)

428
ABSENCE OF IRRADIATION GROWTH IN ALPHA-URANIUM ABOVE 430°C. M. Balicki (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 4, 502-4(1958) Sept.

Kunz and Holder (TID-7502) predicted that the irradiation growth at very low temperatures when diffusion is very low also should be low. This has been confirmed. The prediction, however, that irradiation growth should double on increasing the irradiation temperatures from 200 to 500°C apparently did not materialize. This finding invalidates the anisotropic diffusion theory. The opinion is advanced that such a conclusion need not necessarily be true. Facts and arguments are offered which permit one to consider such theories of growth as basically valid, in spite of the absence of the growth when the irradiation temperature varies from 200 to 450°C. (A.C.)

RADIOACTIVE WASTE

429
THE MIGRATION OF RADIOACTIVE SUBSTANCES FROM AN OPEN WATER RESERVOIR. D. I. Il'in, A. I. Petrova, and N. Ya. Chepkasova. Atomnaya Energ. 5, 75-7(1958). (In Russian)

Waste disposal into the ground was studied by checking the migration of radioactive isotopes in open water under natural conditions. The results are presented from measurements on cross sections of drilled holes. Tables showing the β activity in the reservoir water and in the drilled holes were prepared. The experiments showed that Sr, Cs, and other rare-earth elements are well absorbed by sedimentary rocks and that such ground is suitable for the storage of atomic waste. (R.V.J.)

REACTORS

General

Refer also to abstracts 487, 490, and 499.

430 AECU-3607(Vols.I and II)
General Electric Co. Atomic Power Equipment Dept., Schenectady, N. Y.
FINAL PHYSICS REPORT FOR THE ENGINEERING TEST REACTOR. VOLUME I. B. Wolfe. VOLUME II.

W. Cegelski and W. Machell. June 25, 1956. (Issued in two volumes: Vol. I, 295p. and Vol. II, 287p.) For Kaiser Engineers Div., Henry J. Kaiser Co. $7.00(OTS).

The physics of the Engineering Test Reactor final design is summarized. (T.R.H.)

431 ANL-5914
Argonne National Lab., Lemont, Ill.
SELECTED VALUES OF THE PHYSICAL PROPERTIES OF VARIOUS MATERIALS. F. J. Tebo. Sept. 1958. 261p. Contract W-31-109-eng-38. $4.00(OTS).

Selected physical properties of various solids, liquids, and gases of interest in nuclear reactor heat transfer and fluid flow analysis are presented. In most cases, values for thermal conductivity, specific heat, density, viscosity, and Prandtl numbers are given as functions of temperature. A table of room temperatures values of some properties was compiled on materials for which data as a function of temperature were not found. A short list of references to additional physical property data on many materials is provided at the end of the compilation. The values presented were compiled after a brief survey of the classified and unclassified literature. Much of the data came from sources most frequently used for reference, such as the Reactor Handbook and the Liquid Metals Handbook. (auth)

432 BMI-1290
Battelle Memorial Inst., Columbus, Ohio.
AN IN-PILE GAS-COOLED LOOP INSTALLED AT THE BATTELLE RESEARCH REACTOR. George T. Bodnar, Wallace J. Stevens, Gerald A. Francis, Sherwood L. Fawcett, and Albert M. Rockwood. Sept. 16, 1958. 34p. Contract W-7405-eng-92. $1.00(OTS).

A developmental program was conducted to provide a loop facility for use in evaluating fuel specimens for gas-cooled-reactor applications. The program included the design, construction, and operation of a recirculating in-pile loop featuring high-pressure gas as the primary coolant. The loop facility was designed for gas pressures of up to 200 psig and gas-flow rates up to 0.415 lb per sec with nitrogen as the coolant. Design features incorporated into the facility induced the mounting of the complete "package" on the movable bridge at the Battelle Research Reactor (BRR). This provided ease in moving the loop away from the reactor core for service and specimen transfers. The loop design featured an aluminum pressure wall and concentric counterflow gas passages with static-gas insulation adjacent to all pressure walls. The entire circulating system was located beneath the water level of the pool to provide shielding and simplicity. The blower was designed for use at 750°F inlet-gas temperature, and it featured both oil and water cooling. The instrumentation was designed to protect personnel and equipment, and to provide information on the specimen during irradiation. The specimen-transfer mechanism was designed to utilize pool-water shielding while moving a dry specimen from the loop cask located approximately 20 ft below the pool surface. The complete loop system was subjected to both out-of-pile and in-pile evaluation. The blower has operated satisfactorily over 2000 hr and specimen transfers have been effected without water leakage into the loop or transfer cask. (auth)

433 CF-58-8-33
Oak Ridge National Lab., Tenn.
SCREENING TESTS OF MECHANICAL PIPE JOINTS FOR A FUSED SALT REACTOR SYSTEM. W. B. McDonald, E. Storto, and A. S. Olson. Aug. 13, 1958. 118p. Contract [W-7405-eng-26]. $18.30(ph OTS); $6.00(mf OTS).

The testing and evaluation of three types of mechanical joints in a circulating molten fluoride salt system, at temperatures up to 1500°F, were accomplished. The feasibility of these joints for use in a large scale molten salt system is discussed. Design criteria and operating techniques are described. Measurements were made of the leakage rates of helium through the joints. The effects of thermal cycling, atmospheric oxidation, salt corrosion, and thermal stresses were noted. Disassembly and reassembly procedures are described. (auth)

434 CF-58-10-34
Oak Ridge National Lab., Tenn.
ESTIMATE OF POTENTIAL FUEL REPROCESSING, REVISION NO. 25—PART A. J. W. Ullmann. Oct. 2, 1958. 8p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

The power and estimated reprocessing load is tabulated for existing and proposed United States and United States built reactors of 10 kw or greater thermal power. (auth)

435 HW-50364
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE DEPENDENCE OF THERMAL STRESSES IN CYLINDRICAL REACTOR FUEL ELEMENTS UPON THE METHOD OF COOLING. K. R. Merckx. July 1, 1957. 25p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Thermal stresses and strains within cylindrical uranium reactor fuel elements cooled by various methods are determined with a method of analysis which uses a material model relating the strain rate, temperature, strain, and stress. Solid and hollow cylindrical fuel elements internally, externally, and internally-externally cooled operating in the temperature range 200 to 600°C are used as numerical examples. For the cases with equal temperature drops, the stresses vary by 8%, while the plastic strains vary 140%. The thermal stresses and strains in solid and hollow fuel elements externally and internally-externally cooled are compared for equal power generations. The maximum stress may be reduced 35% and the maximum plastic strain 75% if a solid fuel element is replaced by an internally-externally cooled fuel element (inner radius/outer radius = 0.4) producing the same power per foot. (auth)

436 HW-54850
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
BASES FOR SELECTION OF PRESSURE TUBE DESIGN FOR PLUTONIUM RECYCLE TEST REACTOR. J. C. Fox. Aug. 15, 1958. 21p. Contract W-31-109-Eng-52. $0.75(OTS).

A comparison was made between a pressure tube-type reactor and pressure vessel type reactor to determine which type more nearly fulfilled the design criteria. The results of the comparison are summarized. From an examination of the results, it was concluded that the pressure tube reactor holds many advantages over the pressure vessel type for use in the Plutonium Recycle Program. (W.L.H.)

437 HW-54909
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE EFFECT OF TEMPERATURE ON FLOW AND FLOW INDICATION IN THE PRIMARY COOLANT SYSTEM OF THE PRTR. W. S. Figg and J. Muraoka. Feb. 10, 1958. 4p. Contract [W-31-109-Eng-52.] $1.80(ph OTS); $1.80(mf OTS).

Adequate primary coolant flow may be maintained

U OF I

after failure of electrical power to the PRPR primary coolant pumps by the addition of 650 (lb)(sq ft) flywheels to each of the two normally operating pumps. This moment of inertia is based on a 1750 rpm pump speed and a calculated system pressure drop of about 86 psi. Flywheel momentum is the principal source of circulation power during about the first one hundred seconds after the electrical failure. After this period natural convection provides sufficient coolant flow. (auth)

438 HW-57225 A2
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PLUTONIUM RECYCLE PROGRAM MONTHLY REPORT—AUGUST 1958. F. W. Albaugh, L. P. Bupp, P. F. Gast, and W. H. Reas. Sept. 15, 1958. 19p. \$3.30(ph OTS); \$2.40(mf OTS).

The status of various projects of the Plutonium Recycle Reactor Experiment is briefly summarized. (For preceding period see HW-56914-A2.) (W.D.M.)

439 HW-57344
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
HYDRAULIC CHARACTERISTICS OF THE MARK-I FUEL ELEMENT. T. W. Ambrose and E. D. Waters. Sept. 4, 1958. 4p. Contract [W-31-109-Eng-52]. \$1.80(ph OTS); \$1.80(mf OTS).

One of the proposed fuel elements for the PRTR is the 19-rod cluster (Mark I). To assist in the evaluation of this fuel element, pressure drop data across the fuel element were determined experimentally in light water at room temperature. These data indicate satisfactory agreement with values obtained using standard analytical techniques. A summary of the data is shown. (W.D.M.)

440 IDO-16448
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
STABILITY ANALYSIS OF THE ETR WITH REACTIVITY FEEDBACK THROUGH THE TEMPERATURE COEFFICIENT. S. R. Gossmann. Sept. 18, 1958. 20p. Contract AT(10-1)-205. \$0.75(OTS).

A frequency response analysis of the ETR at 175 Mw was performed. Differential equations and transfer functions describing the transient behavior of the reactor core power production and heat transfer are presented along with those for the heat exchanger and the temperature control loop. The reactor is a power generator with inherent feedback. The feedback transfer function is derived and the open and closed-loop frequency response of the system is investigated to determine reactor stability and the effectiveness of the temperature controller. As expected, the ETR is found to possess a very high stability margin. On the other hand, the temperature controller is found to be ineffective in its present configuration. The closed-loop response is taken to be the response of the reactor with its inherent feedback and has no reference to an external control system such as would be used for maintaining a constant power level. (auth)

441 IDO-16452
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
REACTOR PROJECTS BRANCH QUARTERLY PROGRESS REPORT [FOR] JANUARY, FEBRUARY, MARCH, 1958. G. O. Bright, ed. Sept. 10, 1958. 98p. Contract AT(10-1)-205. \$2.50(OTS).

A number of Spert I transient experiments, both step and ramp, were conducted. During one of the tests a portion of a fuel plate was evidently melted, with no adverse effects on the reactor or to personnel. It was determined that the maximum equilibrium power level of the B-12/64 core was 18 Mw. The average void coefficient for the B-12/64 core was measured. Several energy coefficients of the Spert I cores were calculated, using experimental values of void coefficient and temperature coefficient. An investigation of noise observed on thermocouple traces has shown that a mechanical-electrical transducing mechanism is possible whenever alumel wire is used. Several zero-power reactor transfer functions which were calculated for use in the pile oscillator program are presented. A complete description of the techniques used in calibrating the Spert neutron level detectors in terms of power is presented. The simple Fuch's model for prompt power bursts was extended to include a power law dependence on energy release and a time delay between energy release and the appearance of shutdown effects. Comparison with experimental data is presented. The Fuch's model was also extended to the treatment of ramp functions of reactivity addition. The shutdown effects to be expected from fuel plate expansion and direct moderator heating are determined on the basis of experimental values of the void and temperature coefficients. A refinement of the moderator temperature rise calculation was made. Reactivity calculations for possible Spert III cores were made using an IBM-704. Preliminary shutdown reactivity results are presented. Plans for modification of the Spert I reactor to use APPR fuel assemblies were completed and component construction was initiated. Progress in the construction of the Spert II reactor is detailed, and a description of the reactor internal structure is presented. A summary of the Spert III construction progress, control rod design and test program, and the preparation for some of the engineering tests to be performed on the reactor after acceptance are detailed. (For preceding period see IDO-16437.) (auth)

442 KAPL-1910
Knolls Atomic Power Lab., Schenectady, N. Y.
TRANSISTORIZED TRIP CIRCUIT FOR CRITICAL ASSEMBLIES. E. J. Wade and D. S. Davidson. Feb. 24, 1958. 18p. Contract W-31-109-Eng-52. \$0.75(OTS).

A transistor trip circuit intended for critical assemblies and which provides maximum safety against human error or component failure is described. Five inputs from ion chambers are used, and up to 20 safety rods may be controlled. (auth)

443 KAPL-M-DRB-2
Knolls Atomic Power Lab., Schenectady, N. Y.
THE WORTH OF SINGLE CONTROL RODS IN HYDROGENOUS REACTORS. D. R. Bach and M. E. Way. July 28, 1958. 49p. Contract W-31-109-Eng-52. \$7.80(ph OTS); \$3.30(mf OTS).

Reactivity measurements of the worth of single slab type control rods were made in five Flexible Plastic Reactor assemblies. An analysis of the experiments indicate that the relative worths can be described by a two group absorption area scheme. Measurements of the dependence of control rod worth on radial position were made. A comparison of these measurements with statistical weight calculations shows good agreement. (W.D.M.)

444 KAPL-M-DWJ-8
Knolls Atomic Power Lab., Schenectady, N. Y.
REMARKS ON CALCULATION OF HEAT GENERATION IN REACTOR STRUCTURES DUE TO RADIATION ABSORPTION. D. W. Johnson. June 1958. 11p. Contract W-31-109-Eng-52. \$1.80(ph OTS); \$1.80(mf OTS).

Prepared for the ANS Annual Meeting Special Session on Shielding, Los Angeles, Calif., June 1958.

The calculation of stresses and temperature distribution and the accuracies required and obtained in heat generation calculations are discussed to show their relation to the calculation of heat generation rates due to radiation absorption. (W.D.M.)

445 KAPL-M-WS-3
Knolls Atomic Power Lab., Schenectady, N. Y.
ON THE TEMPERATURE DEPENDENT PROPERTIES OF AN 8 1/4 INCH SLAB REACTOR. J. A. Bistline, R. G. Luce, and W. Skolnik. Sept. 3, 1958. 30p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Experiments to determine the critical load of an $8\frac{1}{4} \times 30 \times 32$ inch reactor as a function of moderator temperature are described. The reactor contained water, highly enriched uranium, and Zircaloy. The metal-water ratio was 1.53 to 1 and a temperature range of 79.5 to 513°F was covered in five steps. (W.D.M.)

446 NAA-SR-2470
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
AN IN-PILE LOOP STUDY OF THE PERFORMANCE OF POLYPHENYL REACTOR COOLANTS. William N. Bley. Sept. 15, 1958. 143p. Contract AT-11-1-GEN-8 (Originally AT(04-3)-88). $2.75(OTS).

An in-pile loop experiment was performed to evaluate several promising polyphenyl materials for use as reactor moderator coolants. Isopropyl diphenyl, diphenyl, a mixture of Santowax O and Santowax M, and Santowax R were circulated in an in-pile loop containing a uranium heater, at bulk fluid temperatures of 500 to 700°F and at fluid velocities of 10 to 20 ft/sec over the heat transfer surfaces. Heat fluxes ranged from 120,000 to 200,000 Btu/hr-ft^2. Peak reactor fluxes surrounding the in-pile assembly were 5×10^{13} thermal neutrons/cm^2-sec, 1.2×10^{12} fast neutrons/cm^2-sec, and 0.6 watt/gm gamma heating. No significant differences between the materials irradiated were apparent insofar as radiation stability, heat transfer properties, and corrosion were concerned. Radiation decomposition rates were slightly greater than those measured in previous work. However, the decomposition rates were not unreasonable. Coolant activation and corrosion were negligible. Heat transfer characteristics were not adversely affected by physical property changes or high radiation fields. (auth)

447 NP-6954
Brussels. Centre D'Étude de l'Énergie Nucléaire.
PAPPORTS D'AVANCEMENT COUVRANT LA PERIODE DU 1er AVRIL AU 30 JUIN 1958. (Progress reports of Reactor Theory and Applied Mathematics Departments covering the period April 1 to June 30, 1958.) July 1958. 56p.

The age of neutrons in the BR-1 was determined, and a total value of 1.429×10^{-8} was obtained. The use of rods with fins clad with magnox in the BR-1 gives a power increase and permits the diameter of the rods to be decreased. A calculation was made of the activities liberated in the case of a major accident to the BR-1, and the results are tabulated. The activities present in a channel of the BR-1 after 2 years of operation at 4 Mw, followed by a shutdown of from 0 to 4 months, were calculated and tabulated. The results of a preliminary study on the Wigner energy accumulated in the crystal lattice of graphite at the present and in a year's time are given. From criticality experiments made with uranium rods in the BR-2, the value of the buckling constant was obtained as $B_m^2 = (1.248\ 0.002) \times 10^{-4}$. The results of a study on the most serious accident possible in the BR-2 are reported. The criteria which would be used to determine the moment when the ventilation system of the BR-2 building would be stopped and no more air released to the environment are given. The resistance of the dome of the BR-2 to projectiles was studied. A study is being made of the constants to be used in the calculation of the BR-2 core. The critical radius of the BR-2 was determined for three cases of neutron flux. The thicknesses of the cement walls necessary for shielding rooms containing high gamma sources are tabulated. The variation of the intensity of a Ra–Be neutron source introduced in a reactor was studied as a function of the fraction of the surface covered with cadmium. The work on the construction of the C.E.N. analog calculator is described. (J.S.R.)

448 NRL-5184
Naval Research Lab., Washington, D. C.
NAVAL RESEARCH LABORATORY RESEARCH REACTOR. PART VI. A COMPILATION OF CORE LOADINGS. K. W. Marlow, E. I. Nowstrup, and R. H. Vogt. July 8, 1958. 30p. Project No. NR-543-000.

Part V issued as NRL-5142.

A compilation was made of core loadings of the NRL Research Reactor from September 1956 to July 1958. Properties measured include critical mass, excess reactivity, total mass, and critical rod positions. Configurations investigated include external reflector variations, split cores, and cores containing fuel-free regions. (auth)

449 NRL-5189
Naval Research Lab., Washington, D. C.
NAVAL RESEARCH LABORATORY RESEARCH REACTOR. PART VII. CONTROL AND SAFETY ROD DRIVES. J. M. Frame and M. P. Young. July 15, 1958. 27p. Project No. NR-543-000.

Part VI issued as NRL-5184.

The design of the NRL research reactor control and safety-rod drive system was guided by the desire for extreme safety and maximum reliability and the need for maximum flexibility within the limits of possible core loading configurations. In order to obtain this objective, a unitized rod-drive mechanism was designed which consists basically of a lead screw and a revolving nut. A drive motor, remotely operated from the control room, causes the lead screw to move vertically; the lead screw, coupled to either a safety rod or a control rod, moves its load vertically in or out of the reactor core. The control rod is coupled mechanically to its drive; the safety rods are coupled to their drives by electromagnets. Rod position is measured by a translatory potentiometer and is presented in the control room on a d-c meter. (auth)

450 ORNL-2568
Oak Ridge National Lab., Tenn.
HRP BLANKET PROCESSING STUDIES OF O_2–H_2 HAZARDS IN A LOOP PRESSURIZER. P. A. Haas. Oct. 9, 1958. 28p. Contract W-7405-eng-26. $1.00 (OTS).

Results of experiments made under conditions proposed for homogeneous reactor blanket-processing loop studies indicated that spontaneous $H_2 + O_2$ reactions will not occur frequently enough to seriously hamper operation for reasonable steady state periods and will not result in hazardous equipment failures. Calculated (2 H_2–O_2) concentrations below literature values for explosive concentration limits were detonated with an ignition coil. This result was probably due to segregation of gases, which would be expected from the test system geometry. The pressurizer was not damaged in more than 25 detonation reactions, some of which were for 200 psi H_2 + 100 psi O_2 with no diluent at room temperature. Recorded pressure peaks indicated that pressure rises would be less than 1600 psi in other loop components. The peak pressures would be within the test limit of the pump rotor can (4000 psi) and of all other loop components. (auth)

451 RWC-22-127
Ramo-Wooldridge Corp. Electronic Research Lab., Los Angeles.
POWER BURSTS IN NUCLEAR REACTORS. H. C. Corben. Sept. 4, 1958. 24p. Contract AT(04-3)-165. $0.75(OTS).

It is shown that some of the properties of a power burst in a reactor are independent of either the feedback mechanism or the pile kinetics, and may be described quantitatively with no assumption other than that the pile kinetic equations are nonlinear. The theory refers primarily to the shape of the burst and is applicable chiefly to the faster transients observed in SPERT, KEWB, and BORAX. The data which may be described theoretically in this manner include plots of maximum reactor power times period against the energy to peak of power burst (SPERT, KEWB), of total energy of burst against the period times the maximum power (BORAX), and of the burst width against period (SPERT). Use of the pile kinetic equations allows one to obtain a simple algebraic expression for the reactivity compensated at the time of peak power as a function of reciprocal period α. This expression is in excellent agreement with experiment for the faster SPERT transients and exhibits the correct form of dependence on α for the slower transients. It is therefore pointed out that data which may be so simply described without reference to the feedback mechanism do not furnish information about the nature of this mechanism. (auth)

452
ELECTRICAL REACTOR SIMULATORS. V. V. Korolev and I. I. Sidorova. Atomnaya Energ. 5, 29-43(1958). (In Russian)

The advantages of simulators in reactor calculations are described. An example of coding equations for isotopic composition of reactors is shown on a simulator multigroup machine. To demonstrate the efficiency of the method in studies of unstable reactor processes, an example is given of computations made for an automatic reactor power regulator. The application of computers in criticality studies of power reactors and in determining reactivity temperature coefficients are described. (tr-auth)

453
STUDY OF A MOCK-UP OF THE EXPERIMENTAL REACTOR VVR-S. N. A. Lazukov, I. E. Chelnokov, and V. P. Ivanov. Atomnaya Energ. 5, 44-51(1958). (In Russian)

Results are presented of investigations made of neutron-physical parameters of the VVR-S reactor. The critical mass, maximum and working load, compensating power of control safety rods, and the effects of various factors on the reactivity (water temperature, changes in the reflector, etc.) were determined, and the distribution of neutron density along the height and radius of the active zone was measured. The triggering time of the control rods was verified. (tr-auth)

454
FABRICATION TECHNOLOGY OF CERAMIC FUEL ELEMENTS. II. C. Corsetti (CISE, Milan). Energia nucleare (Milan) 5, 579-90(1958) Sept. (In Italian)

In the second part of the paper on fabrication technology of ceramic fuel elements, the final process involved in the fabrication is described. Particular attention is given the materials technology and the thermal bonding between core and can in ceramic fuel rods. (J.S.R.)

455
XENON POISONING KINETICS IN GAS-SPARGED, MOLTEN FLUORIDE FUELED NUCLEAR REACTORS. Mark T. Robinson (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 4, 270-87(1958) Sept.

A simple phenomenological theory is presented to describe the xenon poisoning of a molten fluoride fueled nuclear reactor which is sparged with a suitable inert gas. The extension of the theory to removal of other fission product species is indicated. The theory is illustrated by a parametric study. It is found that arbitrarily low levels of Xe^{135} can be achieved by adequate sparging of the fuel. Such sparging also frees these reactors from the troublesome rise of the xenon poisoning during shutdowns. No reactivity transients of a serious nature are likely to result from changes in the rates of the xenon removal processes. (auth)

456
EFFECTS OF LOW-LYING EUROPIUM RESONANCES ON THE TEMPERATURE DEFECT IN WATER-MODERATED REACTORS. D. M. Keaveney, T. J. Krieger, and M. L. Storm (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 4, 332-40 (1958) Sept.

The selection of appropriate epithermal group-averaged cross sections for use in a few-group criticality calculation is particularly difficult when resonance absorbers are present. However, by use of the SOFOCATE code for the calculation of thermal spectra in hydrogenous media, it is now practical to include low-lying resonances below 2 ev in the thermal group. Since the SOFOCATE code, which is based on the Wigner-Wilkins differential equation for monatomic hydrogen thermalization, has yielded good agreement with measured spectra in water, it is felt that use of this code and inclusion of low-lying resonances in the thermal group constitute a more accurate and convenient method of treating these resonances than other procedures. As an application of the method, a study was made of some of the effects associated with the use of Eu as a means of reducing the temperature defect in water-moderated reactors. It is shown that the use of natural, unshielded Eu would reduce the temperature defect provided the spectral hardening introduced by the core absorption is sufficiently small. It is also shown that the strong dependence on spectral hardening is due to the presence of the Eu resonances at about 0.4 ev. (auth)

457
BROAD ASPECTS OF ABSORBER MATERIALS SELECTION FOR REACTOR CONTROL. W. K. Anderson (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 4, 357-72(1958) Sept.

The selection of materials for control of nuclear reactors employing a variety of coolants and working over a broad range of neutron spectra are considered from a qualitative standpoint. The materials discussed include hafnium, boron, cadmium, indium, silver, europium, gadolinium, and samarium. A basis for selection of materials is presented which should permit control of practically any reactor proposed today with a minimum of additional development. Materials are discussed from the standpoint of nuclear acceptability, metallurgical fabricability, corrosion resistance, radiation damage resistance, economics, and probable contributions to the over-all radioactivity problem. (auth)

458
MATERIALS, FABRICATION AND PERFORMANCE OF THE EBWR CONTROL RODS. Nicholas Balai (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 4, 429-38(1958) Sept.

Design, procurement, fabrication, and performance testing of control rod materials for the EBWR are reviewed. Construction of the EBWR afforded an opportunity to reduce control rod costs by using a newly developed stainless steel alloy containing high concentrations of natural boron. Costs and performance (to date) of these rods are compared with hafnium-Zircaloy-2 rods. (auth)

459
DEVELOPMENT OF A COMPOSITE CONTROL ROD. G. W. Cunningham, A. K. Foulds, D. L. Keller, and W. E. Ray (Battelle Memorial Inst., Columbus, Ohio and Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 4, 449-57(1958) Sept.

The scarcity and high cost of hafnium for use as a reactor control material has lead to the development of a composite control rod of hafnium and B^{10}. The fabrication technique developed involves the use of a wrought hafnium and a 3.5 wt. % B^{10} dispersion in titanium powder. The two components are placed end to end and clad with titanium by a roll bonding technique involving the use of a restraintive stainless steel rolling frame to control the differences in ductility of the two control materials. These composite control rods have been evaluated by bend and tensile testing, thermal cycling, corrosion testing in high-temperature water, control worth, and information gathered on the resistance of the materials to irradiation damage. Favorable results were obtained from the evaluation study. (auth)

460
A CONTRIBUTION TO BLACK CONTROL ROD WORTH. Jeffery Lewins (Massachusetts Inst. of Tech., Cambridge). Nuclear Sci. and Eng. 4, 500-2(1958) Sept.

Arnold (Nuclear Sci. and Eng. 3, 206(1958)) has made a useful suggestion enabling a calculation of control rod worth entirely from a perturbation analysis. An equivalent cross section is defined for each group which will lead to the same reactor averaged cross section in the original flux ϕ as the actual property perturbation P in the new flux ϕ'. (A.C.)

461
REACTOR TECHNOLOGY (Reaktortechnik). P. R. Arendt. Mosbach/Baden, Germany, Physik Verlag, 1957. 203p. (In German)

A discussion on atomic and nuclear structure serves as an introduction to a book on reactor technology. The characteristics of reactors with natural uranium, research reactors, materials testing reactors, power reactors, breeder reactors, and fast reactors are described. Reactor control and safety are also considered. A discussion on the necessity for the economic application of nuclear energy is presented in the final chapter. (J.S.R.)

462
THE PHYSICAL THEORY OF NEUTRON CHAIN REACTORS. Alvin M. Weinberg and Eugene P. Wigner. Chicago, The University of Chicago Press, 1958. 810p. $13.50.

A unified account of reactor theory which it is hoped will help further the sum of historical, technical, and pedagogical doctrines underlying reactor technology in the field of reactor physics is presented. The work is grouped into the categories of nuclear physics of chain reactors, transport theory, general reactor theory, and heterogeneous reactors. (W.D.M.)

463
FLUID FUEL REACTORS. James A. Lane, H. G. MacPherson, and Frank Maslan, eds. Reading, Mass., Addison-Wesley Publishing Company, Inc., 1958. 999p. $11.50.

A summary of the work done in the United States on fluid fuel reactors is presented. The first part deals with the aqueous homogeneous reactor; most of this work was done at ORNL, with some phases of the work (on slurries) at Westinghouse Atomic Power Division and some work on phosphate solutions at LASL. The second part deals with the fused salt system, which was investigated primarily at ORNL. The third part deals with the bismuth—uranium system, investigated at BNL. The development of aqueous homogeneous reactors is discussed. The nuclear characteristics of one and two region homogeneous reactors are summarized. The properties and technology of aqueous fuel solutions are treated. The integrity of metals in homogeneous reactor media is reviewed. Core and blanket chemical processing is summarized. Design, construction, and costs are discussed. Under molten—salt reactors, chemical aspects of fuels, construction materials, nuclear characteristics, heat-transfer systems, and conceptual designs are considered. The aircraft reactor experiment is summarized. Reactor physics for liquid metal reactor design are reviewed. The composition, properties, and chemical processes of liquid metal fuels are discussed. The metallurgy of construction materials is discussed. Engineering studies of the LMFR are summarized. Two-fluid and single-fluid LMFR designs are compared. Conceptual designs are compared. Conceptual designs of liquid metal fuel gas-cooled reactors, molten plutonium fuel reactors, and liquid metal-uranium oxide slurry reactors are discussed. (W.D.M.)

464
THE TRANSURANIUM ELEMENTS. Glenn T. Seaborg. Reading, Mass., Addison-Wesley Publishing Co., Inc., 1958. 348p. $7.00.

The discovery and history of the transuranium elements are given, with the original discovery experiments described in some detail. The work is grouped into the plutonium story, chemistry of the actinide elements, nuclear information on the transuranium elements, and future synthetic elements. (W.D.M.)

465
U. S. RESEARCH REACTOR OPERATION AND USE. Joel W. Chastain, Jr., ed. Reading, Mass., Addison-Wesley Publishing Company, Inc., 1958. 377p. $7.50.

The various types of research reactors in the U. S. are described. Their characteristics, operating problems, safety considerations, and costs are discussed. Reactor theory is covered only enough to provide the reactor user with a few basic concepts and an understanding of some common terms. (W.D.M.)

Power

Refer also to abstracts 494, 496, 497, and 498.

466 DP-295
Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.
HEAVY WATER MODERATED POWER REACTORS QUARTERLY PROGRESS REPORT [FOR] FEBRUARY,

MARCH, AND APRIL 1958. L. Isakoff, comp. June 1958. 80p. Contract AT(07-2)-1. $2.25(OTS).

Continued progress is reported on the nuclear, engineering, and materials problems associated with four designs of D_2O-cooled-and-moderated 100-Mwe power reactors fueled with tubes of natural uranium metal. Evaluations are given of the quality of several full-size fuel tubes of U−2 wt. % Zr clad with Zircaloy-2 and of two full-size zirconium housing tubes that were fabricated for tests of the fuel assemblies of the D_2O-cooled reactors. A preliminary design and an evaluation cost estimate are presented for a small pressure vessel reactor in which power reactor fuel elements could be irradiated. A relaxation of the ground rules that were established for the du Pont study over a year ago led to examination of reactor types that may lead to lower cost atomic power but would also require substantially more research and development than those considered practicable for operation by July 1962. (For preceding period see DP-285.) (auth)

467 DP-307
Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.
A PRELIMINARY EVALUATION OF GAS COOLING OF POWER REACTORS MODERATED BY HEAVY WATER. R. C. Holmes, L. Bernath, and E. W. Hones. Aug. 1958. 50p. Contract AT(07-2)-1. $1.50(OTS).

A preliminary study of gas-cooled natural uranium power reactors moderated by heavy water and a comparison of them with a similar reactor cooled by heavy water have shown that a reactor cooled by helium holds sufficient economic promise to merit further study. The results indicate that helium cooling might give a lower cost for power by about 10%. However, many other developments must be made in the design of reactors in order to reduce the cost of electrical power from atomic energy to an economical zone of 4 to 6 mills per kwh. The data were generated for the purpose of guiding the over-all research program relating to the production of low cost power from heavy-water-moderated atomic reactors. (auth)

468 HW-51767(Rev.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
FLOW DECAY AFTER POWER FAILURE TO THE PRIMARY COOLANT PUMPS IN THE PRPR. W. S. Figg and T. W. Ambrose. Dec. 13, 1957. 14p. $3.30(ph OTS); $2.40(mf OTS).

During a startup of the PRTR the primary coolant temperature will usually rise from some lower temperature to about 478°F. If the primary coolant pumps are otherwise operating normally, the total actual volumetric flow will rise from below normal, while the actual weight flow will drop from above normal to normal at 478°F. The venturi meters will indicate a volumetric flow below normal and a weight flow above normal at operating temperatures below 478°F. These relationships are plotted. (auth)

469 HW-51832
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PRP REACTOR SHIELD CALCULATIONS. D. E. Woods. Aug. 5, 1957. 6p. Contract [W-31-109-eng-52]. $1.80 (ph OTS); $1.80(mf OTS).

From the neutron fluxes incident on the PRPR shield, the dose rates outside the shields are specified. The radial and top and bottom shields are checked along with an approximate calculation of the total heat load on the shields. It is concluded that the shields are adequate as designed but the heat removal calculation needs further refinement, since the approximate calculations show the heat load to be close to the present design criteria. (W.D.M.)

470 HW-53320
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
REPORT ON PRELIMINARY PRPR MODERATOR INJECTOR TESTS. M. R. Kreiter. Oct. 23, 1957. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70 (mf OTS).

The flow characteristics of sixteen different types of injectors were determined under PRPR flow conditions. The mixing characteristics of each injector were observed as it discharged water upward between a sample array of four PRPR shroud tubes submerged in a large tank of water. (W.D.M.)

471 HW-53637
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PRPR PROCESS TUBE AND GAS SEAL COMPONENTS. Interim Report. P. A. Scott, ed. Nov. 18, 1957. 21p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70 (mf OTS).

Fabrication of test assemblies incorporating initially conceived designs for process tube connections and gas seals were completed, and preliminary testing was started. Flared tubing connections proved satisfactory on the inlet process assembly tested on ELMO-7 and on the other assemblies when hydrostatically tested. (W.D.M.)

472 KAPL-M-SMS-92
Knolls Atomic Power Lab., Schenectady, N. Y.
SAR MAIN COOLANT CHECK VALVE TESTS IN TF-17. T. H. Glasser. July 17, 1958. 39p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

The purpose of TF-17 is to investigate the nature of repetitive slamming of S3G check valves as may be induced in the S3G main coolant piping system, to test methods of prevention of sustained slamming and to evaluate the check valve seat damage caused by slamming. Results of these tests are summarized. (W.L.H.)

473 NDA-14-163
Nuclear Development Corp. of America, White Plains, N. Y.
COMPARISON OF ONE- AND TWO-DIMENSIONAL MULTIGROUP CALCULATIONS FOR THE APDA FAST BREEDER REACTOR. J. H. Ray. Apr. 1, 1957. 25p. For Atomic Power Development Associates, Inc. $4.80 (ph OTS); $2.70(mf OTS).

The results of a one-dimensional spherical multigroup calculation and a two-dimensional cylindrical multigroup calculation are compared. When corrections are made for the different amounts of poison used in the two problems the values of k agree within 1%. The reactivity coefficient of a change in core volume derived from the two-dimensional calculation results agrees to ~ 10% with a similar coefficient derived from one-dimensional results. Power and flux patterns from the two calculations are also compared, and agreement between the two sets of results is shown in the mirror plane in the two-dimensional problem where axial components of the flux gradient are zero. (W.D.M.)

474 NDA-84-11
Nuclear Development Corp. of America, White Plains, N. Y.
EXPERIMENTAL EVALUATION OF AUSTENITIC STAINLESS STEEL PIPING FOR SODIUM-DEUTERIUM

REACTOR. D. Burgreen and J. Cummins. Aug. 26, 1958. 57p. SDR Project. Contract AT(30-3)-256. $9.30(ph OTS); $3.60(mf OTS).

A fabrication study and a testing program were conducted to determine the manufacturing feasibility and strength characteristics of various welded joints in the fuel-coolant tubes and associated pigtails (expansion piping) of the SDR. Tensile tests run on butt-welded tube joints indicated that all the types of welds considered were adequate and of essentially equivalent strength. The major test effort was on fatigue tests of pigtail-header T-joints and pigtail-tube T-joints subject to bending loads. Fatigue tests indicated a life of 100,000 cycles before failure at the design stress. Fatigue test results are correlated with other work in this field. It is concluded that the joints designed for SDR will perform satisfactorily. (auth)

475 NMI-4359
Nuclear Metals, Inc., Cambridge, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period February 21, 1958 through March 18, 1958. J. L. Klein, A. M. White, R. G. Jenkins, D. F. Kaufman, W. B. Nowak, S. Isserow, A. R. Gilman, and S. R. Malcof. Mar. 25, 1958. 22p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $4.80(ph OTS); $2.70(mf OTS).

Development of techniques for extruding, heat treating, and testing U—Zr—Zircaloy clad fuel tubes is reviewed. (For preceding period see NMI-4358.) (D.E.B.)

476 ORNL-2510
Oak Ridge National Lab., Tenn.
THE ORNL GAS-COOLED REACTOR ADVANCED CONCEPTS. Oct. 2, 1958. 89p. Contract W-7405-eng-26. $2.75(OTS).

A few of the uses for which gas cooled reactors may be designed are discussed and a brief commentary on several of the systems that have been suggested for these applications is presented. Fuel element design, power recovery, and instrumentation and control are discussed. To assist future design studies, the more likely possibilities for the coolant, moderator, fuel, and cladding materials are discussed with emphasis on their advantages and disadvantages. (W.D.M.)

477 PRDC-TR-13
Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT FOR JULY 1958. 16p. Contract AT(11-1)-476. $3.30(ph OTS); $2.40(mf OTS).

The design and fabrication status of major reactor components is shown in chart form. Short status statements or completion summaries are given on a number of developmental studies of fuel and reactor materials, nuclear characteristics, and reactor cooling and instrumentation. (For preceding period see PRDC-TR-12.) (D.E.B.)

478
SHIPPINGPORT NUCLEAR POWER PLANT. G. Soldaini (CISE, Milan). Energia nucleare (Milan) 5, 561-78 (1958) Sept. (In Italian)

A description is given of the design and construction of the Shippingport power station, built for the Atomic Energy Commission by Westinghouse. This Atomic Power Station at Shippingport, Pennsylvania, with the pressurized water reactor (PWR) as its heat source (231,000 thermal kilowatts output), is the nation's first large-scale nuclear power plant to generate electricity for civilian purposes. With a net electrical capacity of 60,000 kilowatts, this plant is the largest to be put in operation to date under the AEC's Civilian Power Reactor Program. (auth)

479
THE SHIPPINGPORT PRESSURIZED WATER REACTOR. Reading Mass., Addison-Wesley Publishing Company, Inc., 1958. 595p. $9.50.

Some of the technical history and important details of design, development, and construction of the Shippingport Power Plant are reviewed. Reactor design, fuel element development, core construction, auxiliary systems, water chemistry, reactor physics, instrumentation, testing program, waste disposal, shielding, and hazards are among the many topics discussed in considerable detail. (W.D.M.)

480
SODIUM GRAPHITE REACTORS. Chauncey Starr and Robert W. Dickinson. Reading, Mass., Addison-Wesley Publishing Company, Inc., 1958. 296p. $6.50.

The basically successful operation of the Sodium Reactor Experiment is described, and an effort is made to discuss both the pitfalls encountered and areas remaining to be developed further in the perfection of sodium graphite reactor systems. The large SGR concept is illustrated with a discussion of the Hallam Power Reactor. (W.D.M.)

481
SOLID FUEL REACTORS. Joseph R. Dietrich and Walter H. Zinn, eds. Reading, Mass., Addison-Wesley Publishing Company, Inc., 1958. 856p. $10.75.

An attempt is made to consolidate the information that has been developed for several solid-fuel reactor types which have received serious consideration in the United States but which are not yet represented by operating prototype plants. Information presented is of three main types: general research and development results, design data for specific reactors, and analytical studies. Basic types of reactors discussed are the fast, heavy-water, gas-cooled, organic moderated, and plutonium recycle. Specific reactors discussed are the Experimental Breeder Reactor-II and the Fermi Fast Breeder Reactor. (W.D.M.)

STABLE ISOTOPE SEPARATION

482 AEC-tr-3396
SEPARATION OF ISOTOPES IN A NON-STATIONARY MOLECULAR FLOW. K. O. Sinel'nikov, V. E. Ivanov, B. G. Safronov, Yu. S. Azovsky, and G. G. Aseyev. Translated for Oak Ridge Gaseous Diffusion Plant from Zhur. Ekspl.' i Teoret. Fiz. 34, 327-30(1958). 8p.

A change in isotopic composition was detected in a nonstationary molecular flow of mercury vapor. The time of absorption of mercury on an iron surface and the ratio of the absorption times for the Hg^{198} and Hg^{204} isotopes were computed from the results obtained. The heat of absorption of mercury on iron (15×10^3 cal/mole) is estimated. (auth)

483
ELECTROMAGNETIC ISOTOPE SEPARATORS AND APPLICATIONS OF ELECTROMAGNETICALLY ENRICHED ISOTOPES. J. Koch, ed., R. H. V. M. Dawton, M. L. Smith, and W. Walcher. Amsterdam, North Holland Publishing Company, 1958. 324p.

The first two parts of the book are devoted to the technical description of isotope separators and the applications of enriched isotopes. In the third part of the book a general account is given of a number of fundamental physical problems, which are of importance in separator design and which have a special bearing on the future technological developments. (W.L.H.)

TECHNOLOGY

Feed Materials

Refer also to abstracts 491, 492, and 493.

484
URANIUM ORE PROCESSING. John W. Clegg and Dennis D. Foley, eds. Reading, Mass., Addison-Wesley Publishing Company, Inc., 1958. 444p. $7.50.

The first four orientation chapters treat occurrence and sources, exploration and mining, sampling and analysis, and mineralogy. The next six chapters cover the steps of technology in the order in which they are applied: preliminary treatments like roasting and physical concentrations, leaching with acid or alkaline reagents, separation of the pregnant leach liquor from the unwanted solid gangue, and the recovery of the uranium product from solution, principally by ion exchange and solvent extraction. The next chapter describes in detail six typical plants employing the techniques set forth in preceding chapters. Of the last two chapters, one is on such currently minor sources of uranium as shale, lignite, and phosphate rock, while the other covers health and safety in mining and milling. (W.L.H.)

Raw Materials

485
URANIUM ADSORPTION FROM LEACH SLURRIES. Paul Noble, Jr., W. I. Watson, I. M. Whittemore, R. A. Carlson, J. C. Huggins, and L. A. McClaine (Arthur D. Little, Inc., San Francisco). Ind. Eng. Chem. 50, 1513-16(1958) Oct.

To promote thickening and clarification in uranium milling, a char adsorbent is added to the slurry of ore and cyanide leach solution, and then screened from the slurry. Di-2-ethylhexyl pyrophosphate is placed on the surface of the char to bond with uranium. A full description of the process is presented, including graphs and a flowsheet diagram. (J.R.D.)

PATENTS

486
REFINEMENT OF FISSILE METALS. J. E. Antill (to U. K. Atomic Energy Authority). British Patent 792,347. Nuclear Eng. 3, 466(1958) Oct.

The removal of all fission products from metallic fuel elements after irradiation in a nuclear reactor without converting the metal from the metallic stage is described. A charge of at least one non-metallic compound which is immiscible with the metal and has an affinity for fission products, is added in the bottom of a crucible under an ingot of irradiated metal and the charge and the ingot are then subjected to a zone melting process, e.g., by passing the assembly vertically downwards through an electric furnace at the rate of 0.25 in./hour. Most of the activity arising from fission products will concentrate in the top 2cm of the ingot.

487
CLOSURE FOR PRESSURE VESSEL. (To Babcock and Wilcox Co., U.S.A.). British Patent 792,401. Nuclear Eng. 3, 466(1958) Oct.

Closures secured by studs and nuts are held tight against a seating by heating the studs to a predetermined temperature, and screwing down the nuts. The tension is then increased upon cooling, the nuts can be rotated, and the closure applied, from a remote position.

488
RADIATION INDICATOR, PARTICULARLY FOR RADIOACTIVE RADIATION. (to Forsvarets Forskningsinstitutt, Norway). British Patent 792,424. Nuclear Eng. 3, 466(1958) Oct.

A thin leaf carried by an extended conducting filament constitutes the movable electrode of an electrometer. When moving towards the fixed electrode the leaf rotates about the axis of the filament. The leaf is so arranged that each time a certain charge has been attained, it will make contact with the fixed electrode and then immediately swing back to start again. The oscillation frequency of the leaf will give an indication of the intensity of the occurring ion current and hence of the radiation received.

489
COBALT–CHROMIUM ALLOY. G. T. Harris and H. C. Child (to William Jessop and Sons, Ltd.). British Patent 792,447. Nuclear Eng. 3, 466(1958) Oct.

The fabrication of chromium–cobalt alloys with a minimum cobalt content of 41% and cerium up to 1% is described. The properties include rupture strength at high temperature and forgeability.

490
METHOD OF AND APPARATUS FOR DETECTING BREAKS IN NUCLEAR REACTOR FUEL ROD SHEATHS. (to Atomic Energy of Canada, Ltd., U.S.A.). British Patent 793,297. Nuclear Eng. 3, 466(1958) Oct.

A neutron detector is placed near the duct carrying the effluent coolant from the reactor at such a distance from the reactor fuel element that neutron-emitting radioactive substances in the coolant having half-lives not exceeding that of N^{16}, and gamma-ray-emitting radioactive substances capable of producing photoneutrons and having half-lives not exceeding that of N^{17} decay to a negligible activity value. Neutrons released in the coolant by the decaying of fission products, which have entered the coolant through a perforation failure in the sheath, are detected in a neutron counter assembly to which an amplifier and discriminator is attached. When working with heavy water the masking effect of photo-neutron activity is minimized by purification of the heavy water, by allowing only a small volume of it near the counter, and by delaying the heavy water in the path from the reactor to the counter.

491
PRODUCTION OF URANIUM AND PLUTONIUM. R. H. Myers (to U. K. Atomic Energy Authority). British Patent 792,951. Nuclear Eng. 3, 466(1958) Oct.

Metal of high purity, suitable for conversion into shapes without the need for casting, is obtained by a process in which a mixture of a powdered oxide of the metal and particulate alkaline earth metal is heated to produce a reaction product of beads of the uranium or plutonium metal, dispersed in a mass of alkaline earth metal oxide. This is leached with water and/or aqueous nitric acid of 20% concentration. The metal can be compacted and sintered, in vacuo or in a protective atmosphere.

492
PRODUCTION OF URANIUM. R. H. Myers (to U. K. Atomic Energy Authority). British Patent 792,952. Nuclear Eng. 3, 466(1958) Oct.

When magnesium is used in the process described in B.P. 792,951, for the reduction of uranium dioxide, the metal produced tends to be pyrophoric. This can be avoided by including, in the mixture of uranium dioxide and magnesium, a proportion of alkaline earth metal chloride, afterwards leaching with dilute mineral, or acetic acid.

493
PRODUCTION OF URANIUM METAL. J. H. Buddery (to U. K. Atomic Energy Authority). British Patent 792,953. Nuclear Eng. 3, 466(1958) Oct.

A modification of B.P. 792,952, uranium dioxide and magnesium metal mixed with magnesium chloride in certain proportions, is heated in a non-reactive vessel to 1200°C in an inert atmosphere. This temperature is maintained for at least one hour to promote growth of the uranium particles, then the reaction product is leached with dilute aqueous acid, the uranium particles are washed and vacuum freeze dried.

494
CONTROL OF ATOMIC POWER REACTORS. (to Atomic Energy of Canada, Ltd., Canada). British Patent 792,972. Nuclear Eng. 3, 466(1958) Oct.

Two types of control are necessary: fine control by neutron absorbing rods, by movement of reflector parts, or by variation of the level of the liquid moderator, and high-speed control for emergency shut-down. Hitherto it was thought impossible to effect an emergency shutdown quickly enough by lowering the liquid level in the reactor vessel, but a method has been found to drain the moderator from the reactor core into a suitable storage space at such a rapid rate that shut-off rods are not required. This system is based on the use of gas (helium) pressure to keep the moderator level in the reactor vessel at its desired height. The moderator liquid flows rapidly by gravity into a storage chamber, when the gas pressure in this chamber is rapidly released.

495
PRODUCTION OF POLYMERS WITH IONIZING RADIATION. (to Esso Research and Engg. Co., U.S.A.). British Patent 793,575. Nuclear Eng. 3, 466(1958) Oct.

A method of carrying out co-polymerization reactions, by exposing the reagents to radiation from a nuclear reactor or from fission products is described. A mixture of 60 to 100 parts of a conjugated diolefin, and up to 40 parts of a vinyl aromatic, is exposed to ionizing radiation of 100,000 to 5,000,000 r/h long enough to form a polymer suitable for use as a drying oil. The irradiated material is passed to shielded storage tanks for its activity to decay, and is then fractionated and otherwise treated.

496
IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. P. Fortescue and J. P. Middleton (to United Kingdom Atomic Energy Authority). Aug. 6, 1958. British Patent 799,212. Nuclear Power 3, 524(1958) Oct.

Considerable saving in pumping power in the gas circulation circuit is achieved by directly linking a gas turbine to the compressor and incorporating it in the coolant circuit. In principle the whole of the heat output is passed on to the secondary heat exchanger, but in fact there will be a small temperature drop across the turbine. It is particularly applicable to gas-cooled, solid homogeneous or gaseous-fuelled reactors. In the design described, primary coolant is helium pressurized to 10 atm, inlet and outlet temperatures are 350 and 750°C and the heat output is approximately 30Mw. Turbine inlet and outlet pressures are 142.4 and 117.8 psi and the compressor has a compression ratio of 1.2771 with an inlet pressure of 115.5 psi.

497
IMPROVEMENTS RELATING TO POWER PLANT INCLUDING A NUCLEAR REACTOR. W. Eccles (to Metropolitan-Vickers Electrical Co., Ltd.). July 9. 1958. British Patent 797,725. Nuclear Power 3, 524 (1958) Oct.

Using a cascaded bank of heat exchangers operating at high, medium, and low pressures a variable load can be supplied from a reactor plant. The coolant passes through them from high to low pressure and if the demanded load falls below the reactor output, steam is discharged through the boilers progressively and finally from the l.p. side to the condenser. If the required load exceeds output, steam from an auxiliary furnace is brought into the turbine. The temperature of the coolant may be controlled either by bypassing feed water past the low pressure economizer or varying the pressure in the low pressure boiler.

498
NUCLEAR REACTOR AND METHOD OF OPERATI SAME. (to Babcock & Wilcox, U.S.A.). Aug. 13, 1 . British Patent 799,725. Nuclear Power 3, 524(1958) Oct.

Cooling water flows upwards through the core, emerging as a steam-water mixture. After separation in a ring of whirl chamber steam separators, the steam passes down through the blanket where it is superheated and out of the pressure vessel to the point of use. Both fissionable and fertile elements are constructed so that they can be interchangeable to achieve maximum burnup and to maintain constant ratio of core to blanket heat output. By shifting each element at loading a rough control of the superheat in the steam is possible.

499
IMPROVEMENTS RELATING TO NUCLEAR REACTORS. A. W. Aiken (to Metropolitan-Vickers Electrical Co., Ltd.). July 30, 1958. British Patent 799,001. Nuclear Power 3, 524(1958) Oct.

At high neutron energies the cross-sections of most substances become very low so that control of fast reactors by a neutron absorber is not generally satisfactory and it is usually achieved by removal of part of the fuel. However, Metrovick here suggest the use of liquid lithium which is a good moderator and efficient absorber of thermal neutrons. With a melting point of 186°C it would be liquid at the high temperatures anticipated in fast reactors. It is contained in a closed circuit, the control rod itself consisting of two concentric flow and return pipes. Either the effective volume or the poistion of the liquid may be varied to give the required control, the 'rod' is attached to the fixed pipes by expandable tubing. The liquid circulates through a heat exchanger, a small by-pass permits continuous removal of by-products and any necessary replacement of lithium, and heating coils are provided to keep the lithium liquid during shutdown.

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